

Department of Environmental Quality  
Division of INL Oversight  
and Radiation Control

## **ENVIRONMENTAL SURVEILLANCE PROGRAM QUARTERLY DATA REPORT**

**January – March, 2004**



**State of Idaho**  
**Division of INL Oversight and Radiation**  
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# Table of Acronyms

ANL-W	- Argonne National Laboratory West	MDA	- minimum detectable activity
BBWI	- Bechtel BWXT Idaho, LLC	MDC	- minimum detectable concentration
CERCLA	- Comprehensive Environmental Response Compensation and Liability Act	NIST	- National Institute of Standards and Technology
CFA	- Central Facilities Area	nCi/L	- nanocuries per liter
DEQ-INL	- The State of Idaho, Division of Idaho National Laboratory Oversight and Radiation Control	NOAA	- National Oceanic and Atmospheric Administration
DOE	- U.S. Department of Energy	NRF	- Naval Reactors Facility
EIC	- electret ionization chamber	pCi/L	- picocuries per liter
EML	- Environmental Monitoring Laboratory	pCi/m <sup>3</sup>	- picocuries per cubic meter
ESP	- Environmental Surveillance Program	PM <sub>10</sub>	- particulate matter with aerodynamic diameter less than or equal to 10 micrometers
HPIC	- high-pressure ion chamber	PCE	- perchloroethene
LLD	- lower limit of detection	QA/QC	- Quality Assurance/Quality Control
IBL	- Idaho Bureau of Laboratories	RCRA	- Resource Conservation and Recovery Act
INEEL	- Idaho National Engineering & Environmental Laboratory	RWMC	- Radioactive Waste Management Complex
INTEC	- Idaho Nuclear Technology and Engineering Center	SD	- standard deviation
LSC	- liquid scintillation counting	TAN	- Test Area North
µg/L	- micrograms per liter	TCE	- trichloroethene
mg/L	- milligrams per liter	TDS	- total dissolved solids
mR/hr	- milliRoentgen per hour	TSP	- total suspended particulate
µR/hr	- microRoentgen per hour	TSS	- total suspended solids
		USGS	- U.S. Geological Survey
		VOC	- volatile organic compound

# Introduction

The state of Idaho, Division of Idaho National Laboratory Oversight and Radiation Control (DEQ-INL) Environmental Surveillance Program (ESP) is conducted at locations on the INEEL, on the boundaries of the INEEL, and at distant locations to the INEEL in accordance with accepted monitoring procedures and management practices. This program is designed to provide the people of the state of Idaho with independently evaluated information about the impacts of the Department of Energy's (DOE) activities in Idaho.

The primary objective for DEQ-INL's ESP is to maintain an independent environmental monitoring and verification program designed to verify and supplement DOE's data and programs. This program is also used to provide the citizens of Idaho with information that has been independently evaluated to enable them to reach informed conclusions about DOE activities in Idaho and potential impacts to public health and the environment.

Results of the ESP are published using two distinct reporting formats: quarterly data reports and an annual ESP report. The annual ESP report is designed for a more broad audience and summarizes the results of the ESP for the previous four quarters. The annual report's primary emphasis is to focus on trends, ascertain the impacts of DOE operations on the environment, and confirm the validity of DOE monitoring programs. This quarterly report is designed to provide the mechanism to document the results of the ESP on a quarterly basis and provide detailed data to those who wish to "see the numbers." It is organized according to the media sampled and also provides a quality assurance assessment.

## Air and Precipitation Monitoring Results

The ESP operated eight air monitoring stations on and near the INEEL as well as two monitoring stations distant from the INEEL during the first quarter, 2004 (**Figure 1**). These stations employed instrumentation for collecting airborne particulate matter (TSP and PM<sub>10</sub>), gaseous radioiodine, precipitation, and water vapor for tritium analysis (**Table 1**). The Shoshone-Bannock Tribes operated an air monitoring station located at Fort Hall. Because this station uses identical instrumentation and sampling protocol, the DEQ-INL reports the data as an additional background site.

Starting in the first quarter of 2003, DEQ-INL designated the high-volume total suspended particulate (TSP) air sampler as the primary air sampler, thus replacing the aging PM<sub>10</sub> samplers. There are currently three PM<sub>10</sub> samplers collecting supplementary air data, along with radioiodine, at Fort Hall, Mud Lake, and Atomic City.

Weekly gross alpha and gross beta radioactivity results for filters from the TSP samplers are presented in **Appendix A** and summarized in **Table 2**. Gross alpha and gross beta radioactivity concentrations reported from the particulate samples were within the range of expected values for naturally occurring radioactivity observed historically. Monthly averages for gross beta concentrations for each location are presented in **Figures 2** through **12**. The monthly averages are consistent with background values. Fluctuations in the monthly values are typical of observed seasonal variations.

Weekly gross alpha and gross beta radioactivity results for the PM<sub>10</sub> particulate air filters are presented in **Appendix B** and summarized in **Table 3**. Gross alpha and gross beta radioactivity concentrations reported from the particulate samples were within the range of expected values for naturally occurring radioactivity.

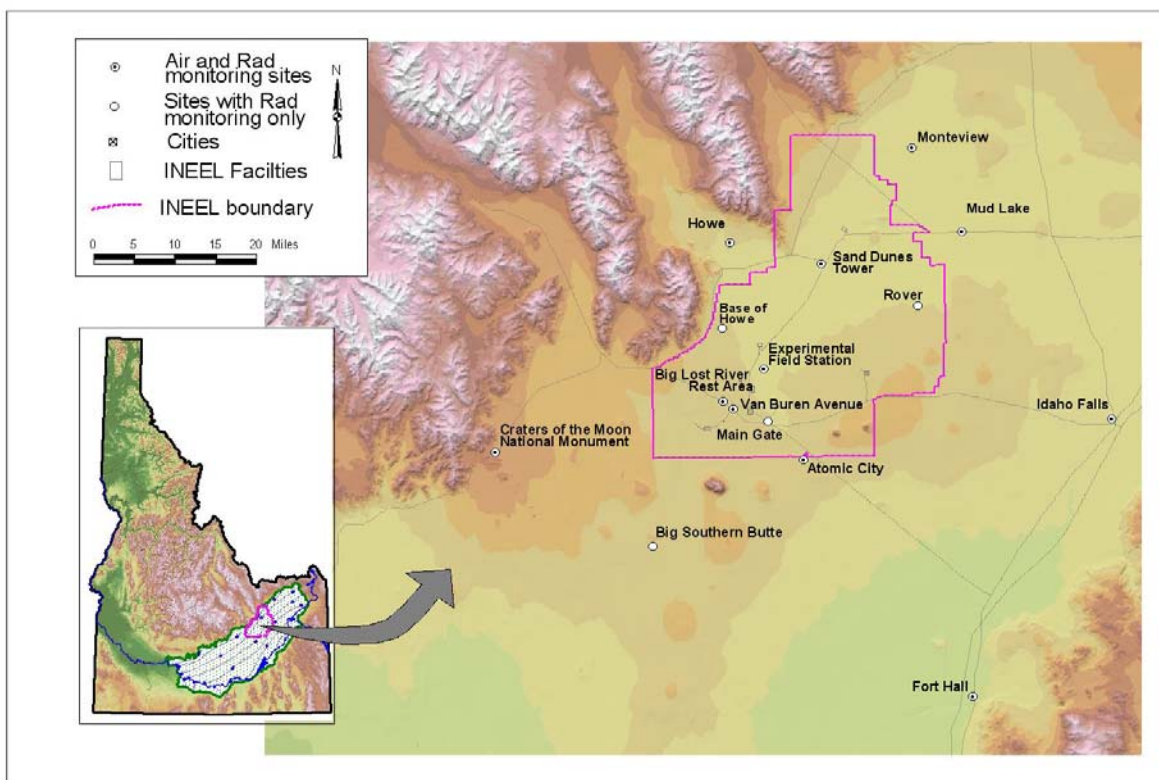
Composites of filters collected using TSP and PM<sub>10</sub> samplers during the course of a calendar quarter are analyzed using gamma spectroscopy. Typically, gamma spectroscopy results are only reported when exceeding a minimum detectable activity (MDA) or minimum detectable concentration (MDC). Gamma spectroscopy results for the first quarter of 2004 for TSP filters are presented in **Table 4** and gamma spectroscopy results for PM<sub>10</sub> filters are presented in **Table 5**. The only reported gamma-emitting radionuclide detected was beryllium-7, a naturally occurring, cosmogenic radionuclide.

Annual composites of filters collected using TSP and PM<sub>10</sub> samplers are also analyzed using radiochemical separation techniques. The samples are analyzed for strontium-90, plutonium-238, plutonium-239/240, and americium-241. The results of radiochemical separation can be found in **Table 6** and **Table 7**. Results indicate activity concentrations exceeding the MDC in some instances, but well below the DEQ-INL action level for the specific radionuclides. Measurable quantities of these radionuclides are expected in the environment due to historic above ground testing of nuclear weapons.

Sample media, which collects gaseous radioiodine in air, were analyzed from 11 sample locations. No radioactive isotopes of iodine, specifically iodine-131, were detected on the weekly charcoal cartridges.

Atmospheric moisture samples were collected at 11 locations and analyzed for tritium. Atmospheric tritium concentrations were determined using the amount of tritium measured in the quantity of atmospheric moisture collected per volume of air sampled. Reported values are the result of either a single sample or a weighted mean when more than one atmospheric moisture sample was collected during the calendar quarter. No atmospheric tritium was measured at onsite or offsite locations during the first quarter of 2004. Average atmospheric tritium concentrations are presented in **Table 8**.

Precipitation samples were collected at six monitoring locations during the first quarter of 2004. Precipitation samples are analyzed for tritium and gamma-emitting radionuclides. Tritium and gamma-emitting radionuclides were below minimum detectable concentration in precipitation collected during the first quarter of 2004. Tritium and cesium-137 analysis results are presented in **Table 9**. Reported values are either the result of a single sample or a weighted mean when more than one precipitation sample was collected during the calendar quarter.



**Figure 1.** Air and radiation monitoring sites.

**Table 1.** Sampling locations and sample type.

Station Locations	Sample type <sup>1</sup>				
	PM <sub>10</sub>	TSP	Radioiodine	Water Vapor	Precipitation
<b>On-site Locations</b>					
Big Lost River Rest Area		<input type="checkbox"/>	<input type="checkbox"/>	■	■
Experimental Field Station		<input type="checkbox"/>	<input type="checkbox"/>	■	
Sand Dunes Tower		<input type="checkbox"/>	<input type="checkbox"/>	■	
Van Buren Avenue		<input type="checkbox"/>	<input type="checkbox"/>	■	
<b>Boundary Locations</b>					
Atomic City	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	■	■
Howe		<input type="checkbox"/>	<input type="checkbox"/>	■	■
Monteview		<input type="checkbox"/>	<input type="checkbox"/>	■	■
Mud Lake	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	■	■
<b>Distant Locations</b>					
Craters of the Moon		<input type="checkbox"/>	<input type="checkbox"/>	■	
Fort Hall <sup>2</sup>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	■	
Idaho Falls		<input type="checkbox"/>	<input type="checkbox"/>	■	■

<sup>1</sup> ☐ Samples collected weekly; ■ Samples collected quarterly.  
<sup>2</sup> Operated by Shoshone-Bannock Tribes.

**Table 2.** Range of alpha and beta concentrations for TSP filters, first quarter, 2004. Concentrations are reported in  $1 \times 10^{-3}$  pCi/m<sup>3</sup>.

Reported in the following position:

Station Location	Concentration					
	Gross Alpha			Gross Beta		
<b>On-Site Locations</b>						
Big Lost River Rest Area	0.2	-	2.5	11.7	-	66.8
Experimental Field Station	0.1	-	3.5	11.0	-	89.2
Sand Dunes Tower	0.1	-	3.7	10.4	-	79.8
Van Buren Avenue	0.2	-	2.8	10.9	-	81.2
<b>Boundary Locations</b>						
Atomic City	0.2	-	1.2	12.1	-	86.1
Howe	0.1	-	2.6	10.0	-	73.5
Montevieu	0.2	-	3.5	9.6	-	68.9
Mud Lake	0.1	-	3.8	9.8	-	87.8
<b>Distant Locations</b>						
Craters of the Moon	0.2	-	1.0	9.7	-	48.4
Fort Hall <sup>1</sup>	0.2	-	3.1	7.9	-	67.0
Idaho Falls	0.2	-	3.0	10.5	-	82.9

<sup>1</sup> Operated by Shoshone-Bannock Tribes.

**Table 3.** Range of alpha and beta concentrations for PM<sub>10</sub> filters, first quarter, 2004. Concentrations are reported in  $1 \times 10^{-3}$  pCi/m<sup>3</sup>.

Reported in 1x10 <sup>-6</sup> pCi/ml						
Station Location	Concentration					
	Gross Alpha			Gross Beta		
<b>Boundary Locations</b>						
Atomic City	0.1	-	2.6	15.0	-	157.3
Mud Lake	0.2	-	2.7	12.4	-	146.2
<b>Distant Locations</b>						
Fort Hall <sup>1</sup>	0.0	-	4.9	12.7	-	101.6
<sup>1</sup> Operated by Shoshone-Bannock Tribes.						

**Table 4.** Gamma spectroscopy analysis data of TSP filters, composite sample, first quarter, 2004. Concentrations are reported in  $1 \times 10^{-3}$  pCi/m<sup>3</sup> with associated uncertainty ( $\pm 2$  SD), minimum detectable concentration (MDC), and correspond to filter composites collected during the calendar year.

Station Location	Naturally Occurring Radionuclide Beryllium-7		Man-Made Gamma Emitting Radionuclides
	Concentration	± 2 SD	
<b>On-site Locations</b>			
Big Lost River Rest Area	63	1	<MDC
Experimental Field Station	65	1	<MDC
Sand Dunes Tower	63	1	<MDC
Van Buren Avenue	68	1	<MDC
<b>Boundary Locations</b>			
Atomic City	77	1	<MDC
Howe	64	1	<MDC
Montevue	55	1	<MDC
Mud Lake	61	1	<MDC
<b>Distant Locations</b>			
Craters of the Moon	60	1	<MDC
Fort Hall <sup>1</sup>	60	1	<MDC
Idaho Falls	63	1	<MDC
<sup>1</sup> Operated by Shoshone-Bannock Tribes.			

**Table 5.** Gamma spectroscopy analysis data of PM<sub>10</sub> filters, composite sample, first quarter, 2004. Concentrations are reported in  $1 \times 10^{-3}$  pCi/m<sup>3</sup> with associated uncertainty ( $\pm 2$  SD), minimum detectable concentration (MDC), and correspond to filter composites collected during the calendar year.

Station Location	Naturally Occurring Radionuclide Beryllium-7		Man-Made Gamma Emitting Radionuclides
	Concentration	± 2 SD	
<b>Boundary Locations</b>			
Atomic City	89	2	<MDC
Mud Lake	63	2	<MDC
<b>Distant Locations</b>			
Fort Hall <sup>1</sup>	85	2	<MDC
<sup>1</sup> Operated by Shoshone-Bannock Tribes.			

**Table 6.** Annual radiochemical separation analysis data for TSP particulate filters collected during 2003. Concentrations<sup>1</sup> are reported in  $1 \times 10^{-6}$  pCi/m<sup>3</sup> with associated uncertainty ( $\pm 2$  SD), minimum detectable concentration (MDC), and correspond to filter composites collected during the calendar year.

Station Location	Americium-241			Strontium-90		
	Concentration	$\pm 2$ SD	MDC	Concentration	$\pm 2$ SD	MDC
<b>On-Site Locations</b>						
Big Lost River Rest Area	0.0	0.0	1.0	4.4	12.4	22.4
Experimental Field Station	0.8	1.1	1.5	20.9	13.0	18.1
Sand Dunes Tower	0.9	1.1	0.9	1.1	10.3	19.2
Van Buren Avenue	1.6 <sup>2</sup>	1.6	1.1	23.1	15.0	21.5
<b>Boundary Locations</b>						
Atomic City	0.8	1.1	1.0	18.2	14.2	21.3
Howe	1.0 <sup>2</sup>	1.1	0.9	-7.7	9.5	21.2
Montevieu	0.7	1.0	0.9	-0.4	10.1	19.4
Mud Lake	1.0	1.4	1.8	10.7	13.3	21.6
<b>Distant Locations</b>						
Craters of the Moon	0.5	1.0	1.6	-7.5	8.9	19.8
Fort Hall <sup>2</sup>	0.2	0.7	1.7	7.6	12.7	21.5
Idaho Falls	0.4	0.8	1.0	10.6	13.9	22.8
<sup>1</sup> Measurable quantities of these radionuclides are expected in the environment due to historic above-ground testing of nuclear weapons. DEQ-INL's action levels of 19 for americium-241, 190 for strontium-90, 21 for plutonium-238, and 20 for plutonium-239/240 (in $1 \times 10^{-6}$ pCi/m <sup>3</sup> ) are 10 percent of the compliance values listed for the specific radionuclide in 40 CFR 61, Appendix E, Table 3. Field sample concentrations which exceed these amounts require further investigation. <sup>2</sup> Operated by Shoshone-Bannock Tribes.						

**Table 6 continued.** Annual radiochemical separation analysis data for TSP particulate filters collected during 2003. Concentrations<sup>1</sup> are reported in  $1 \times 10^{-6}$  pCi/m<sup>3</sup> with associated uncertainty ( $\pm 2$  SD), minimum detectable concentration (MDC), and correspond to filter composites collected during the calendar year.

Station Location	Plutonium-238			Plutonium-239/240		
	Concentration	$\pm 2$ SD	MDC	Concentration	$\pm 2$ SD	MDC
<b>On-Site Locations</b>						
Big Lost River Rest Area	0.7	1.0	0.9	2.0	1.6	0.9
Experimental Field Station	0.3	0.6	0.8	3.0	2.0	1.5
Sand Dunes Tower	0.3	0.7	0.9	2.0	1.6	0.9
Van Buren Avenue	0.9	1.2	1.7	0.7	1.0	0.9
<b>Boundary Locations</b>						
Atomic City	1.0	1.4	1.8	4.6	2.7	1.0
Howe	1.6 <sup>2</sup>	1.5	0.9	1.9	1.6	0.9
Montevieu	1.3 <sup>2</sup>	1.3	0.9	1.3	1.3	0.9
Mud Lake	0.4	0.7	1.0	2.8	2.0	1.0
<b>Distant Locations</b>						
Craters of the Moon	2.1 <sup>2</sup>	1.6	0.8	2.6	1.8	1.4
Fort Hall <sup>2</sup>	0.2	0.7	1.5	2.0	1.7	1.8
Idaho Falls	1.8 <sup>2</sup>	1.7	1.0	1.1	1.3	1.0
<sup>1</sup> Measurable quantities of these radionuclides are expected in the environment due to historic above-ground testing of nuclear weapons. DEQ-INL's action levels of 19 for americium-241, 190 for strontium-90, 21 for plutonium-238, and 20 for plutonium-239/240 (in $1 \times 10^{-6}$ pCi/m <sup>3</sup> ) are 10 percent of the compliance values listed for the specific radionuclide in 40 CFR 61, Appendix E, Table 3. Field sample concentrations which exceed these amounts require further investigation. <sup>2</sup> Operated by Shoshone-Bannock Tribes.						



**Table 7.** Annual radiochemical separation analysis data for PM<sub>10</sub> particulate filters collected during 2003. Concentrations<sup>1</sup> are reported in  $1 \times 10^{-6}$  pCi/m<sup>3</sup> with associated uncertainty ( $\pm 2$  SD), minimum detectable concentration (MDC), and correspond to filter composites collected during the calendar year.

Station Location	Americium-241			Strontium-90		
	Concentration	$\pm 2$ SD	MDC	Concentration	$\pm 2$ SD	MDC
<b>Boundary Locations</b>						
Atomic City	1.2	1.7	1.6	21.5	23.6	37.8
Mud Lake	1.2	1.6	1.5	10.6	23.5	41.0
<b>Distant Locations</b>						
Fort Hall <sup>2</sup>	0.4	1.4	3.0	-9.1	18.0	37.5
<sup>1</sup> Measurable quantities of these radionuclides are expected in the environment due to historic above-ground testing of nuclear weapons. DEQ-INL's action levels of 19 for americium-241, 190 for strontium-90, 21 for plutonium-238, and 20 for plutonium-239/240 (in $1 \times 10^{-6}$ pCi/m <sup>3</sup> ) are 10 percent of the compliance values listed for the specific radionuclide in 40 CFR 61, Appendix E, Table 3. Field sample concentrations which exceed these amounts require further investigation. <sup>2</sup> Operated by Shoshone-Bannock Tribes.						

**Table 7 continued.** Annual radiochemical separation analysis data for PM<sub>10</sub> particulate filters collected during 2003. Concentrations<sup>1</sup> are reported in  $1 \times 10^{-6}$  pCi/m<sup>3</sup> with associated uncertainty ( $\pm 2$  SD), minimum detectable concentration (MDC), and correspond to filter composites collected during the calendar year.

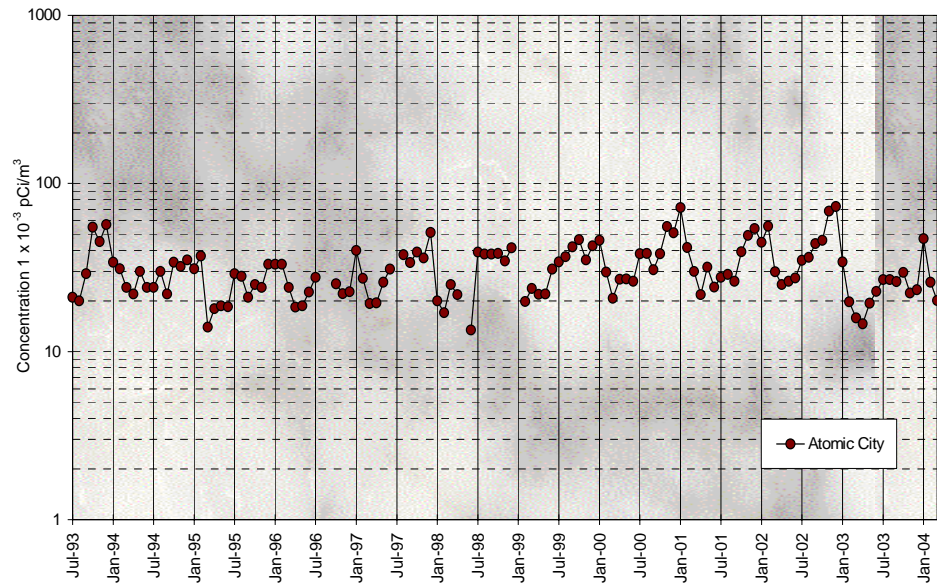
Station Location	Plutonium-238			Plutonium-239/240		
	Concentration	$\pm 2$ SD	MDC	Concentration	$\pm 2$ SD	MDC
<b>Boundary Locations</b>						
Atomic City	0.3	1.1	2.4	3.6	2.7	1.4
Mud Lake	2.1	2.2	1.5	6.4	3.8	1.5
<b>Distant Locations</b>						
Fort Hall <sup>2</sup>	0.7	1.8	3.4	0.0	0.0	1.6
<sup>1</sup> Measurable quantities of these radionuclides are expected in the environment due to historic above-ground testing of nuclear weapons. DEQ-INL's action levels of 19 for americium-241, 190 for strontium-90, 21 for plutonium-238, and 20 for plutonium-239/240 (in $1 \times 10^{-6}$ pCi/m <sup>3</sup> ) are 10 percent of the compliance values listed for the specific radionuclide in 40 CFR 61, Appendix E, Table 3. Field sample concentrations which exceed these amounts require further investigation. <sup>2</sup> Operated by Shoshone-Bannock Tribes.						

**Table 8.** Tritium concentrations from atmospheric moisture, first quarter, 2004. Concentrations are reported in pCi/m<sup>3</sup> with associated uncertainty ( $\pm 2$  SD) and minimum detectable concentration (MDC)..

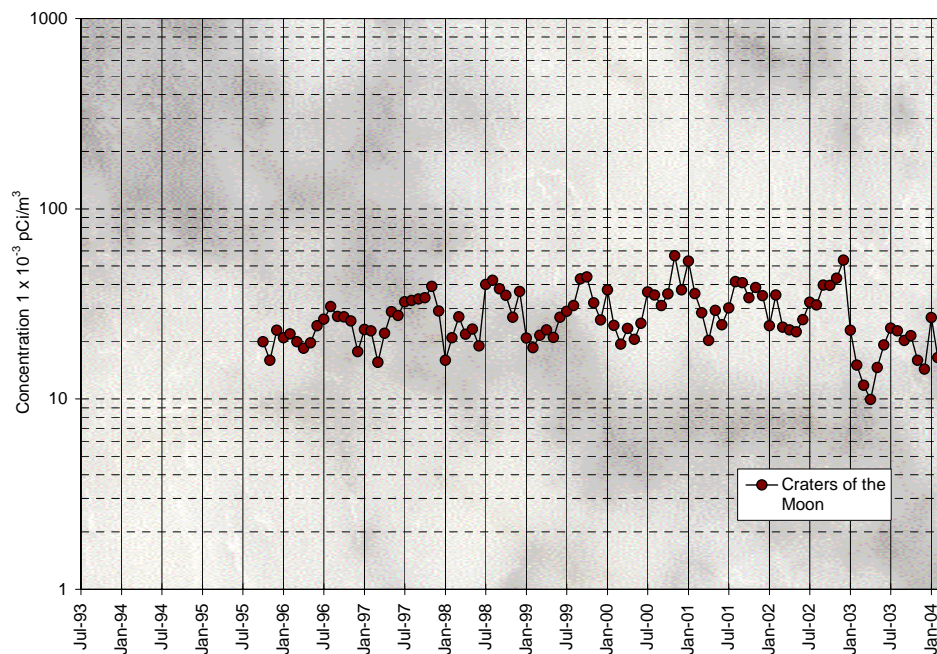
Station Location	Tritium		
	Concentration	$\pm 2$ SD	MDC
<b>On-site Locations</b>			
Big Lost River Rest Area	0.08	0.08	0.14
Experimental Field Station	0.27	0.21	0.34
Sand Dunes Tower	-0.02	0.16	0.28
Van Buren Avenue	0.09	0.19	0.33
<b>Boundary Locations</b>			
Atomic City	0.45 <sup>1</sup>	0.25	0.37
Howe	-0.04	0.15	0.27
Mud Lake	0.06	0.17	0.27
Montevieu	-0.02	0.17	0.30
<b>Distant Locations</b>			
Craters of the Moon	0.07	0.12	0.20
Fort Hall	0.18	0.22	0.34
Idaho Falls	0.15	0.21	0.33
<sup>1</sup> Additional analyses of the sample did not indicate tritium activity greater than the MDC.			

**Table 9.** Tritium and cesium-137 concentrations from precipitation, first quarter, 2004. Concentrations are reported in pCi/L with associated uncertainty ( $\pm 2$  SD) and minimum detectable concentration (MDC)..

Station Location	Tritium			Cesium-137		
	Concentration	$\pm 2$ SD	MDC	Concentration	$\pm 2$ SD	MDC
<b>On-site Locations</b>						
Big Lost River Rest Area	40	70	110	-0.2	1.3	2.2
<b>Boundary Locations</b>						
Atomic City	20	70	110	1.0	1.5	2.5
Howe	70	70	110	0.5	1.5	2.6
Montevieu	0	60	110	0.2	1.5	2.5
Mud Lake	30	70	110	1.0	1.5	2.5
<b>Distant Locations</b>						
Idaho Falls	50	70	110	-0.9	1.4	2.5

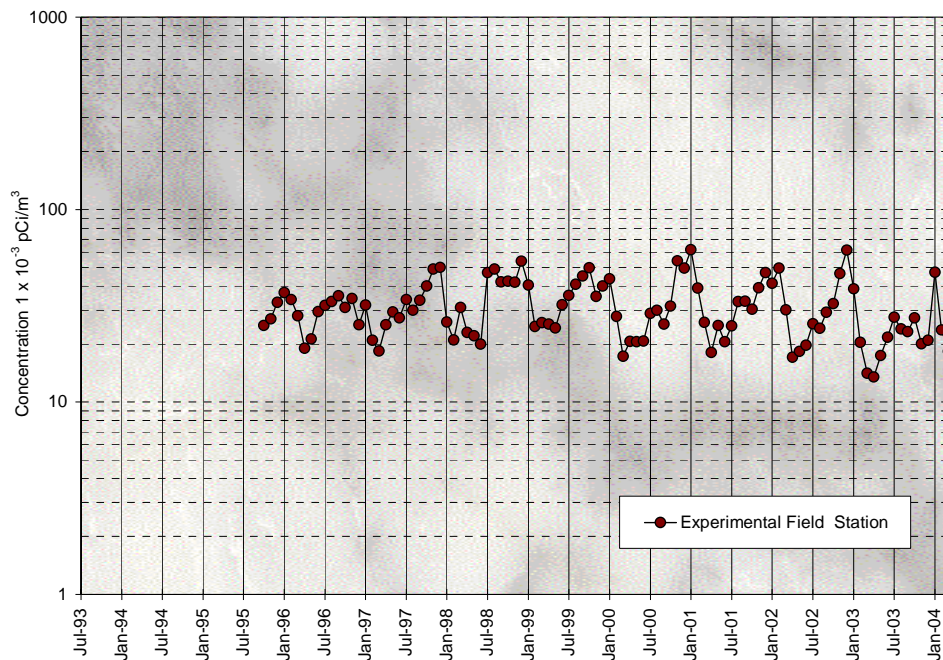


**Figure 2.** Monthly average airborne gross beta results at Atomic City. Includes gross beta from PM<sub>10</sub> samplers through 2002 with gross beta from TSP samplers since January 2003.

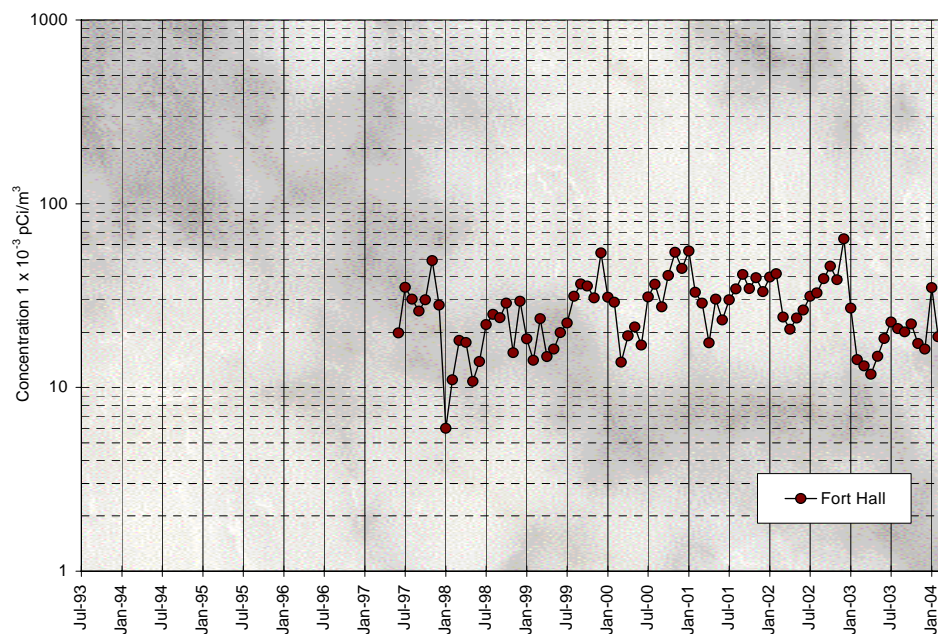


**Figure 3.** Monthly average airborne gross beta results at Craters of the Moon. Includes gross beta from PM<sub>10</sub> samplers through 2002 with gross beta from TSP samplers since January 2003.

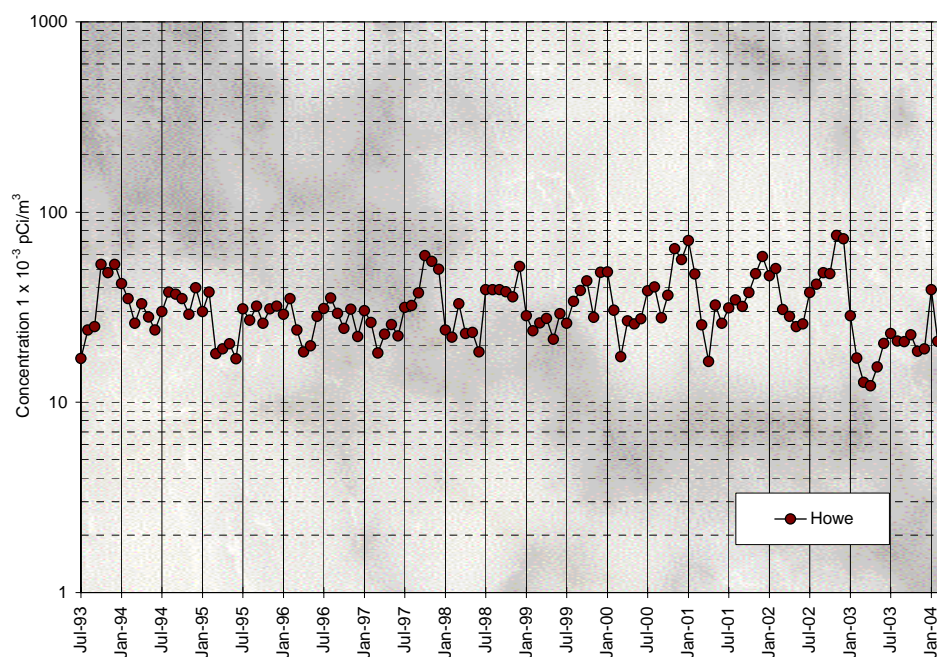




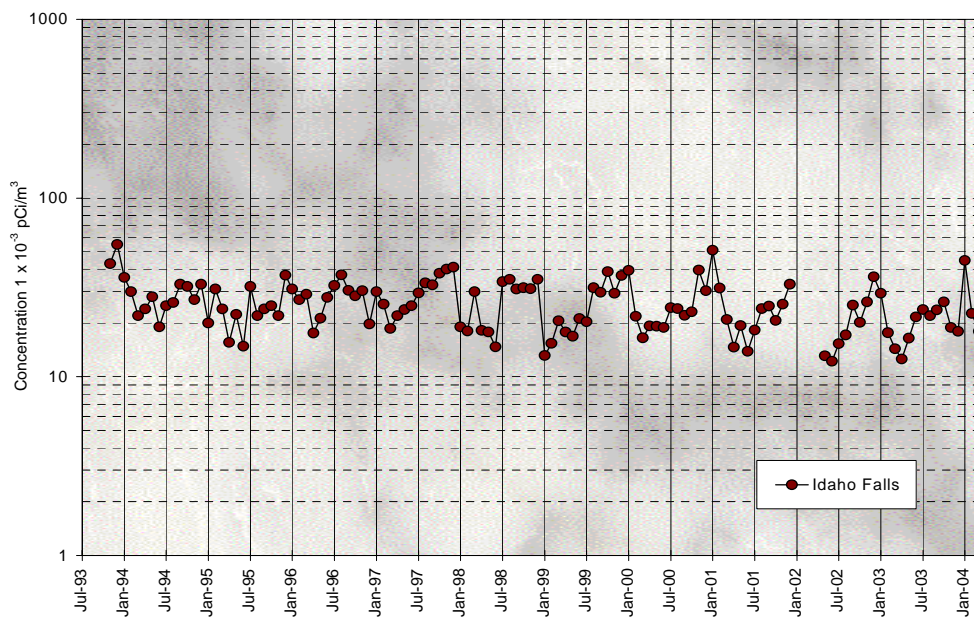
**Figure 4.** Monthly average airborne gross beta results at Experimental Field Station. Includes gross beta from PM<sub>10</sub> samplers through 2002 with gross beta from TSP samplers since January 2003.



**Figure 5.** Monthly average airborne gross beta results at Fort Hall. Includes gross beta from PM<sub>10</sub> samplers through 2002 with gross beta from TSP samplers since January 2003.

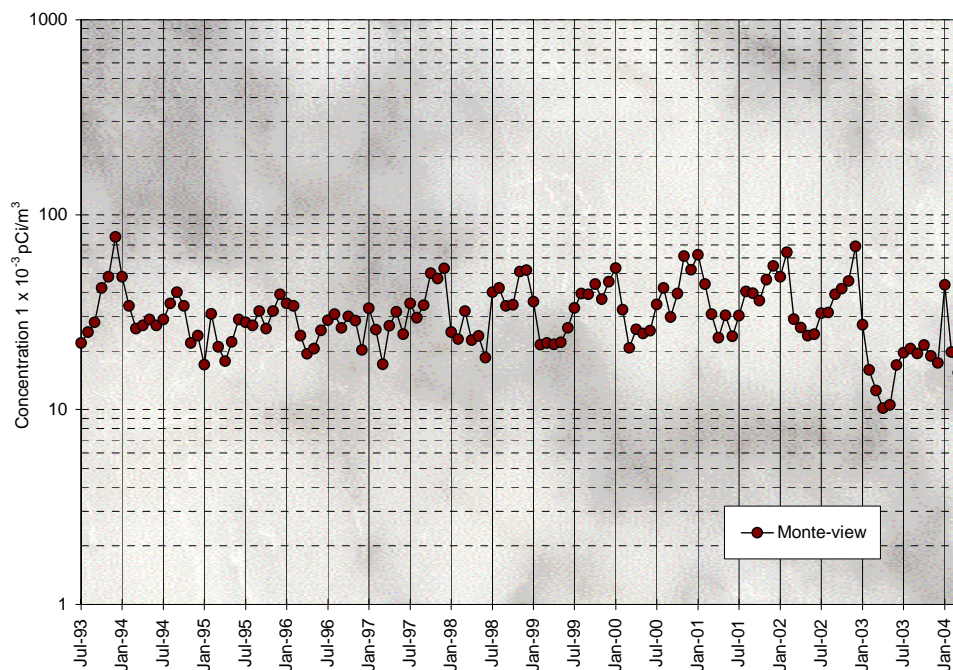


**Figure 6.** Monthly average airborne gross beta results at Howe. Includes gross beta from PM<sub>10</sub> samplers through 2002 with gross beta from TSP samplers since January 2003.

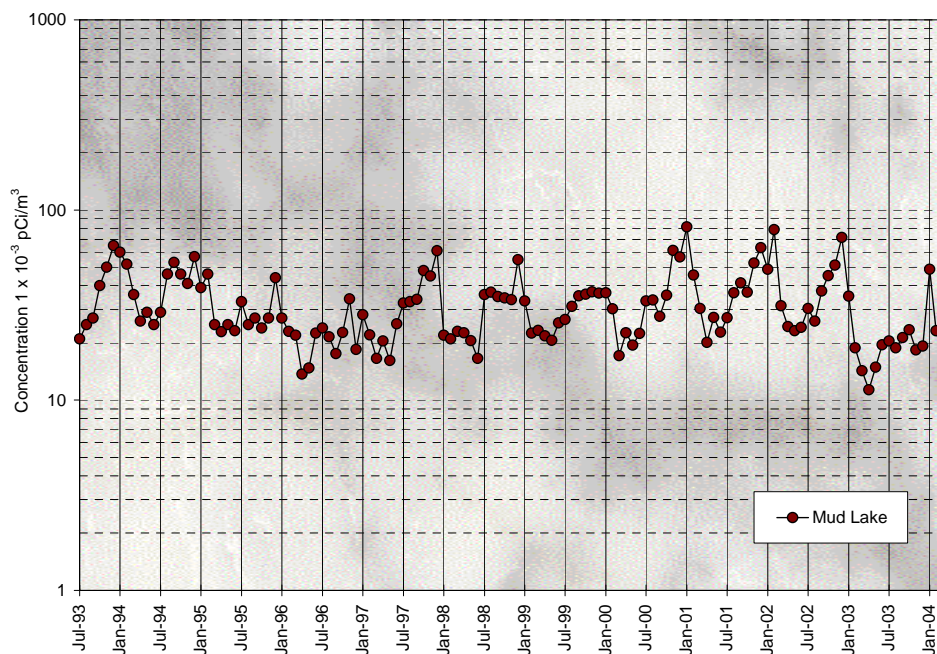


**Figure 7.** Monthly average airborne gross beta results at Idaho Falls. Includes gross beta from PM<sub>10</sub> samplers through 2002 with gross beta from TSP samplers since January 2003.

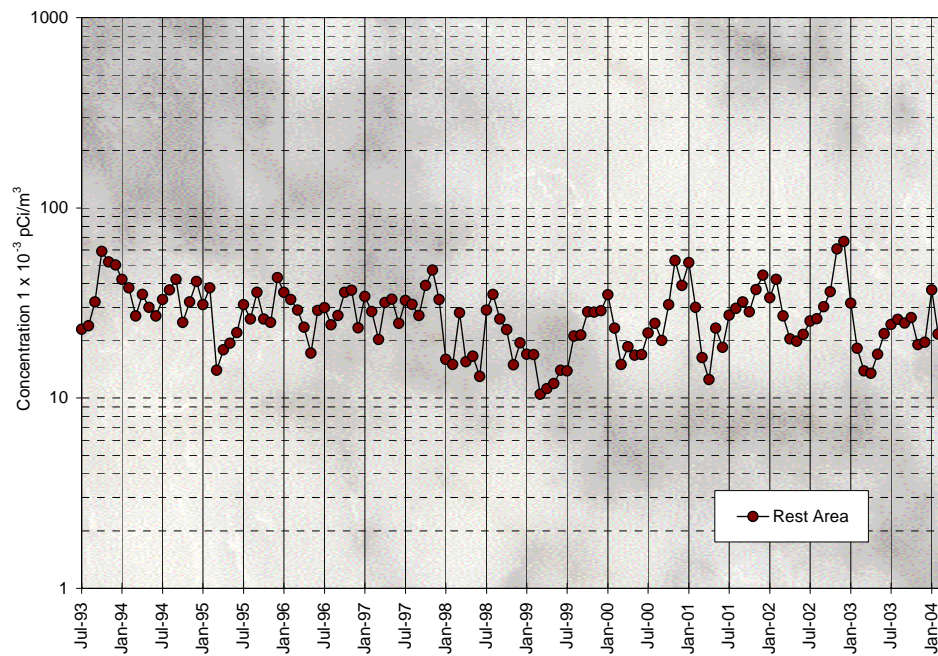




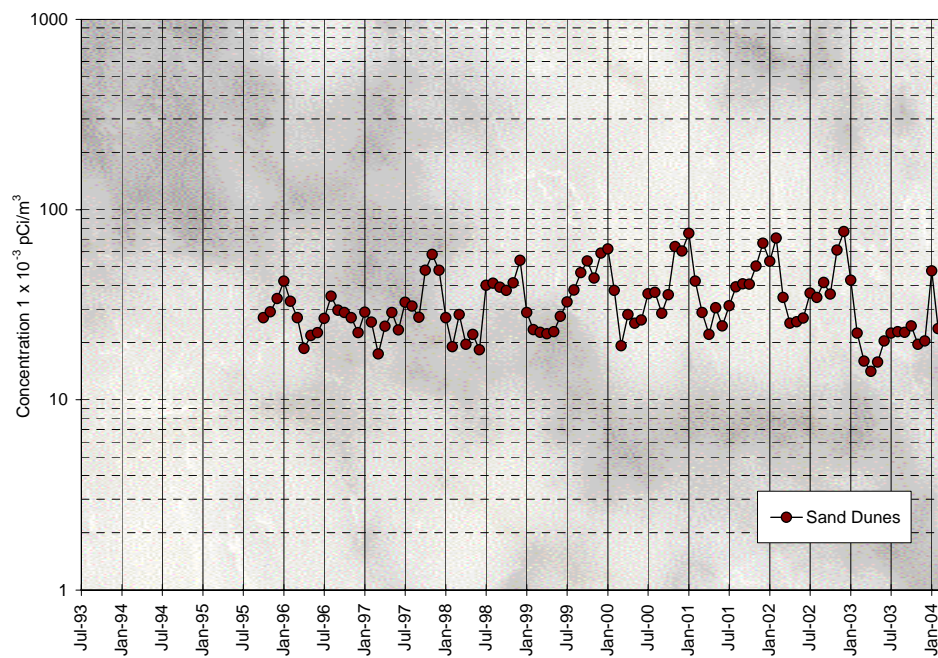
**Figure 8.** Monthly average airborne gross beta results at Montevieu. Includes gross beta from PM<sub>10</sub> samplers through 2002 with gross beta from TSP samplers since January 2003.



**Figure 9.** Monthly average airborne gross beta results at Mud Lake. Includes gross beta from PM<sub>10</sub> samplers through 2002 with gross beta from TSP samplers since January 2003.

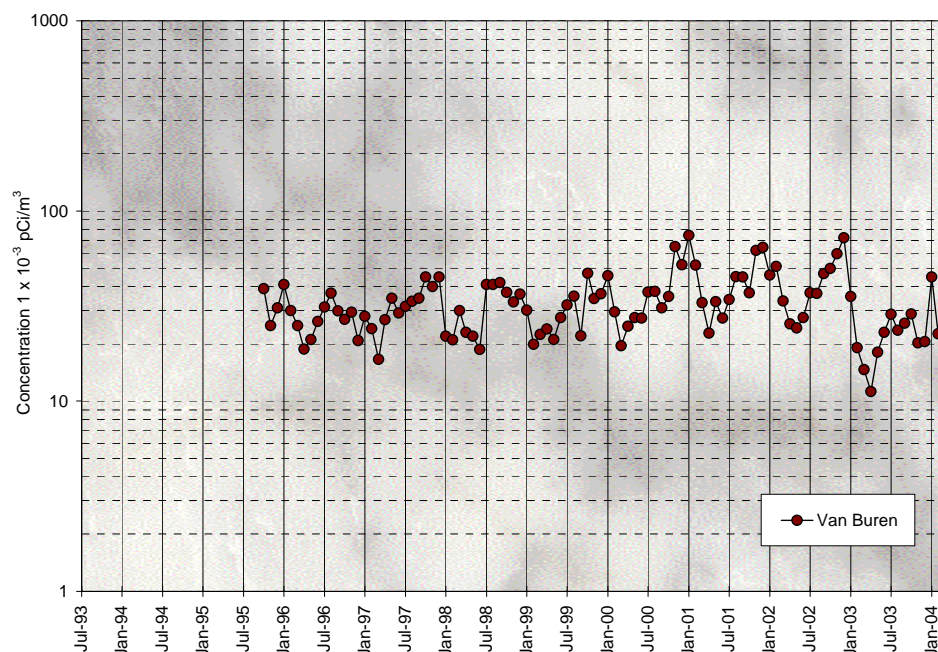


**Figure 10.** Monthly average airborne gross beta results at Big Lost River Rest Area. Includes gross beta from  $\text{PM}_{10}$  samplers through 2002 with gross beta from TSP samplers since January 2003.



**Figure 11.** Monthly average airborne gross beta results at Sand Dunes Tower. Includes gross beta from  $\text{PM}_{10}$  samplers through 2002 with gross beta from TSP samplers since January 2003.





**Figure 12.** Monthly average airborne gross beta results at Van Buren Avenue. Includes gross beta from PM<sub>10</sub> samplers through 2002 with gross beta from TSP samplers since January 2003.

## Environmental Radiation Monitoring Results

The ESP operated 14 environmental radiation stations during the first quarter of 2004 (**Figure 1**). Each of these stations is instrumented with an electret ionization chamber (EIC), and 11 of the stations also have high-pressure ion chambers (HPIC) (**Table 10**). The Shoshone-Bannock Tribes operate an environmental radiation station at Fort Hall. The DEQ-INL reports these results.

HPICs are instruments capable of real-time measurements, and therefore can detect small changes in gamma radiation levels over time. Since HPICs offer real-time gamma radiation measurement and data acquisition, DEQ-INL collects this information electronically and provides graphed data via the world wide web at [www.idahoop.org](http://www.idahoop.org). Contrastly, EICs are a passive integrating system that provides a cumulative measure of environmental gamma radiation exposure. DEQ-INL compared the exposure rates measured by EICs and HPICs and observed that the data correlated very well from both measurement methods (*A Comparison of Three Methods for Measuring Environmental Radiation*, Moser, Kristi, Idaho State University, M.S.Thesis, 2002). Each system is used by DEQ-INL to measure gamma radiation for various radiological monitoring objectives. EICs offer an inexpensive methodology to measure gamma radiation over a wide area, particularly in regions which do not have a power source. EICs can also provide valuable gamma radiation data in the event of an emergency. It is because of this reason that EICs are also deployed at 78 locations by DEQ-INL in a widespread network around the INEEL measuring general background radiation. This information is tabulated in **Appendix C**.



**Table 11** lists the average radiation exposure rates measured by the HPICs for the quarter. Exposure rates were within the expected range of values for historical background radiation.

**Table 12** lists the EIC monitoring results for first quarter, 2004. Because of the inaccessibility of three sites due to deep snow (Base of Howe, Rover, and Big Southern Butte), EICs were not collected from these locations in the fourth quarter of 2003. Data retrieved from these sites when weather conditions allowed access, were added to their respective data sets collected in the first quarter of 2004.

**Table 10.** Summary of instrumentation at radiation monitoring stations.

Station Location	Instrument Type	
	HPIC	EIC
<b>On-site Locations</b>		
Base of Howe	■	■
Big Lost River Rest Area	■	■
Experimental Field Station		■
Main Gate	■	■
Rover	■	■
Sand Dunes Tower	■	■
Van Buren Avenue		■
<b>Boundary Locations</b>		
Atomic City	■	■
Big Southern Butte	■	■
Howe	■	■
Monteview	■	■
Mud Lake	■	■
<b>Distant Locations</b>		
Craters of the Moon		■
Fort Hall <sup>1</sup>	■	■
Idaho Falls	■	■
<sup>1</sup> Operated by Shoshone-Bannock Tribes.		

**Table 11.** Average gamma exposure rates for first quarter 2004, from HPIC network. These rates are expressed in  $\mu\text{R/hr}$ .

Station Location	Exposure Rate	
	Quarterly Average	$\pm 2 \text{ SD}$
<b>On-site Locations</b>		
Base of Howe	11.9	1.3
Big Lost River Rest Area	12.3	1.6
Main Gate	13.9	1.1
Rover	13.5	1.4
Sand Dunes Tower	12.8	1.6
<b>Boundary Locations</b>		
Atomic City	11.1	2.1
Big Southern Butte	10.3	3.0
Howe	11.7	1.5
Monteview	11.0	1.2
Mud Lake	12.3	1.2
<b>Distant Locations</b>		
Fort Hall <sup>1</sup>	11.0	2.3
Idaho Falls	10.3	1.8

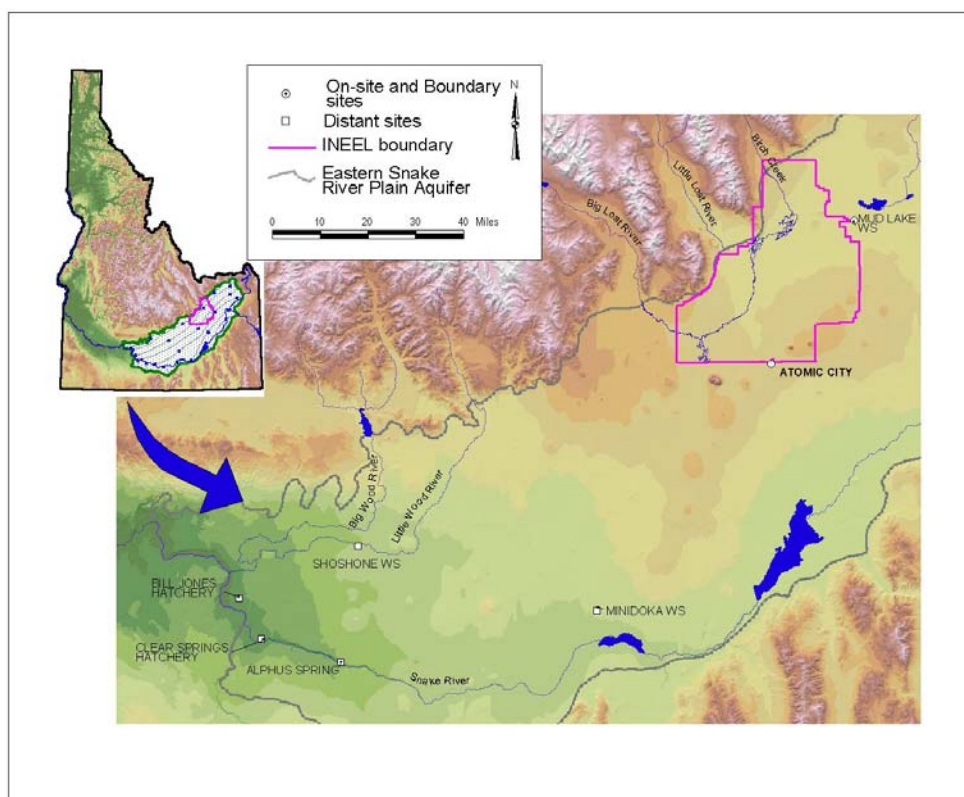
<sup>1</sup> Operated by Shoshone-Bannock Tribes.

**Table 12.** Electret Ionization chamber (EIC) cumulative average exposure results for first quarter, 2004. These rates are expressed in  $\mu\text{R/hr}$ .

Station Location	Exposure Rate	
	Total	$\pm 2 \text{ SD}$
<b>On-site Locations</b>		
Base of Howe	15.7 <sup>1</sup>	2.4
Big Lost River Rest Area	18.4	1.9
Experimental Field Station	20.7	2.0
Main Gate	16.9	2.0
Rover	19.7 <sup>1</sup>	1.4
Sand Dunes Tower	19.2	1.9
Van Buren Avenue	22.0	2.1
<b>Boundary Locations</b>		
Atomic City	18.4	1.9
Big Southern Butte	17.9 <sup>1</sup>	2.2
Howe	14.8	1.8
Monteview	18.9	1.9
Mud Lake	19.0	3.3
<b>Distant Locations</b>		
Craters of the Moon	14.2	1.8
Fort Hall <sup>2</sup>	15.8	1.8
Idaho Falls	15.6	1.8

<sup>1</sup> Quarterly average from this site is the combined average from the fourth quarter of 2003 (inaccessible due to deep snow) and the first quarter of 2004.

<sup>2</sup> Operated by Shoshone-Bannock Tribes.



**Figure 14.** Water monitoring locations.

## Water Monitoring & Verification Results

### Water Monitoring Sampling Program

Seven water monitoring locations were sampled during the first quarter of 2004, two sites near the INEEL boundary and five sites offsite and distant from the INEEL, with duplicate samples collected at one site. Water monitoring sites are shown in **Figure 14** and gross alpha, gross beta, and gamma spectroscopy results are presented in **Table 13**.

No samples returned detectable gross alpha radioactivity this quarter. Occasional detections for gross alpha radioactivity are expected for Snake River Plain Aquifer sites due to naturally occurring uranium and thorium isotopes in the groundwater.

Gross beta radioactivity was detected in samples from two distant sites. Detectable concentrations ranged from  $2.6 \pm 1.1$  to  $4.2 \pm 1.2$  pCi/L. The highest concentration was observed for a sample from the distant location, Alpheus Spring. The typical background range for gross beta radioactivity for the Snake River Plain Aquifer is 0 to 8 pCi/L. Gross beta analyses are conducted as a screening tool for beta-emitting radionuclides that were released due to INEEL operations, such as strontium-90 and technetium-99. Samples from selected onsite locations are sampled for these radionuclides during the second and fourth calendar quarters. No man-made, gamma-emitting radionuclides were detected.

Tritium was not detected in samples collected this quarter using the standard analysis method. Results for tritium analyses are presented in **Table 14**.

Water samples not exceeding the tritium MDC using the standard methods (160 pCi/L) are routinely reanalyzed using an electrolytic enrichment method with a much lower MDC (10 to 14 pCi/L). These samples are all presented in **Table 15**. Values are consistent with typical background levels of tritium of 0 to 40 pCi/L and significantly below the drinking water EPA limit of 20,000 pCi/L.

No samples were collected for trace metals, common ions, or nutrient analyses this quarter.

**Table 13.** Alpha, beta, and gamma concentrations<sup>1</sup> for water monitoring samples, first quarter, 2004. Concentrations are expressed in pCi/L.

Sample Location	Sample Date	Gross Alpha		Gross Beta		Man-made gamma-emitting radionuclide Cesium-137
		Concentration	± 2 SD	Concentration	± 2 SD	Concentration
Onsite and Boundary						
Atomic City	02/11/04	0.4 U	1.0	2.5	1.1	<MDC
Mud Lake Water Supply	02/11/04	0.5 U	1.3	1.6	0.9	<MDC
Offsite and Distant						
Alpheus Spring <sup>2</sup>	02/10/04	1.8 U	3.1	4.2	1.2	<MDC
Bill Jones Hatchery	02/10/04	0.2 U	1.8	1.0 U	1.1	<MDC
Clear Spring <sup>2</sup>	02/10/04	0.2 U	1.5	2.7 U	0.8	<MDC
Minidoka Water Supply	02/10/04	1.8 U	2.0	1.8 U	1.0	<MDC
Shoshone Water Supply	02/10/04	1.8 U	2.1	2.6	1.1	<MDC
Shoshone Water Supply (field duplicate)	02/10/04	1.8 U	1.3	3.0	0.7	<MDC
<sup>1</sup> Data qualifiers: U = non-detection, J = estimate, R = rejected. <MDC – Less than minimum detectable concentration for analysis by gamma spectroscopy.						
<sup>2</sup> Data reflects the average of an actual sample result and the result of a corresponding laboratory split, recount, re-distillation, or re-evaporation.						

**Table 14.** Tritium concentrations<sup>1</sup> for water monitoring samples, first quarter, 2004. Concentrations are expressed in pCi/L.

Expressed in PC/L

Sample Location	Sample Date	Tritium	
		Concentration	± 2 SD
Onsite and Boundary			
Atomic City	02/11/04	90 U	70
Mud Lake Water Supply	02/11/04	0 U	70
Offsite and Distant			
Alpheus Spring	02/10/04	50 U	70
Bill Jones Hatchery <sup>2</sup>	02/10/04	0 U	49
Clear Spring	02/10/04	0 U	70
Minidoka Water Supply	02/10/04	50 U	70
Shoshone Water Supply	02/10/04	10 U	70
Shoshone Water Supply (field duplicate)	02/10/04	20 U	70
<sup>1</sup> Data qualifiers: U = non-detection, J = estimate, R = rejected.			
<sup>2</sup> Data reflects the average of an actual sample result and the result of a corresponding laboratory split, recount, re-distillation, or re-evaporation.			

**Table 15.** Enriched tritium concentrations<sup>1</sup> for water monitoring samples, first quarter, 2004. Concentrations are expressed in pCi/L.

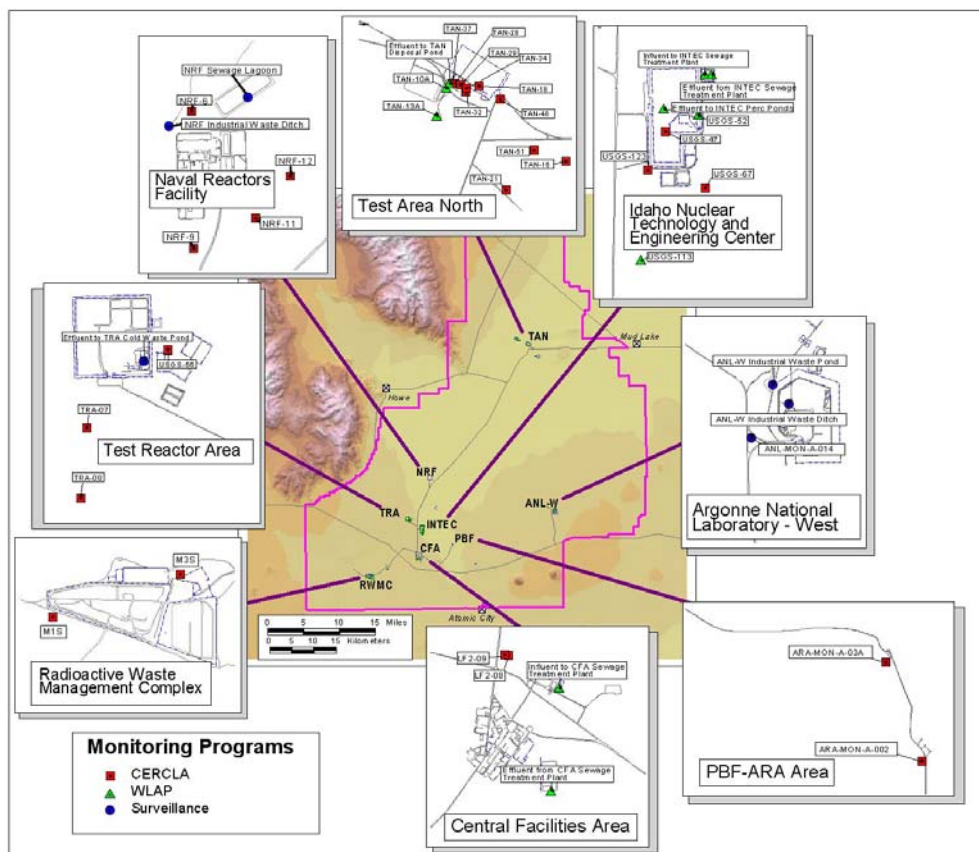
Sample Location	Sample Date	Tritium	
		Concentration	± 2 SD
<b>Onsite and Boundary</b>			
Atomic City	02/11/04	19	7
Mud Lake Water Supply	02/11/04	5 U	6
<b>Offsite and Distant</b>			
Alpheus Spring	02/10/04	37	6
Bill Jones Hatchery <sup>2</sup>	02/10/04	15	4
Clear Spring	02/10/04	16	7
Minidoka Water Supply	02/10/04	12	5
Shoshone Water Supply	02/10/04	39	7
Shoshone Water Supply (field duplicate)	02/10/04	38	7
<sup>1</sup> Data qualifiers: U = non-detection, J = estimate, R = rejected. <sup>2</sup> Data reflects the average of an actual sample result and the result of a corresponding laboratory split, recount, re-distillation, or re-evaporation.			

## Water Verification Sampling Program

Water verification sampling sites are shown on **Figure 15**. During the first quarter of 2004, the DEQ-INL sampled four wells on the INEEL. Radiological results are shown in **Tables 16-21** and the non-radiological data are in **Tables 22-25**. These data are collected primarily to compare results with the co-sampling agencies at the INEEL (i.e., BBWI and the monitoring groups at ANL-W and NRF), so only a brief synopsis follows. Results of the comparisons are reported in the DEQ-INL annual report.

None of the samples collected this quarter contained detectable levels of americium-241, plutonium isotopes, or strontium-90. Tritium was detected in areas of known INEEL contamination, M3S, TRA-7, and TRA-8, at concentrations below the drinking water standard of 20,000 pCi/L. Technetium-99 was also detected in areas of known contamination at M3S and M1S.

Carbon tetrachloride and trichloroethene were detected in well M3S, near the RWMC. These contaminants have migrated down to the aquifer from wastes buried at that facility. The vapors are being pumped from the subsurface and remediated with a treatment system. Elevated chromium concentrations were reported in samples from wells near the RWMC and TRA; concentrations at TRA-7 exceeded the drinking water standard of 100 µg/L.



**Figure 15.** Water verification sampling sites at the INEEL for 2004.

**Table 16.** Reported concentrations<sup>1</sup> of americium-241 in water verification samples, first quarter, 2004. Concentrations are expressed in pCi/L. Samples were not filtered.

2004: Concentrations are expressed in pCi/L. Samples were not filtered.				
Sample Location	Sample Date	Americium-241		
		Concentration	±2 SD	
Groundwater				
M1S	01/27/04	-0.003	U	0.03
M3S	01/27/04	0.008	U	0.031
1 Data qualifiers: U = non-detection, J = estimate, R = rejected.				

<sup>1</sup> Data qualifiers: U = non-detection, J = estimate, R = rejected.

**Table 17.** Reported concentrations<sup>1</sup> of strontium-90 in water verification samples, first quarter, 2004. Concentrations are expressed in pCi/L. Samples were not filtered.

Concentrations are expressed in pCi/L. Samples were not filtered.

Sample Location	Sample Date	Strontium-90	
		Concentration	± 2 SD
Groundwater			
M1S	01/27/04	-0.07 U	0.26
M3S	01/27/04	0.11 U	0.2
TRA-7	03/16/04	-0.1 U	0.14
TRA-8	03/16/04	0.06 U	0.14

<sup>1</sup> Data qualifiers: U = non-detection, J = estimate, R = rejected.

**Table 18.** Reported concentrations<sup>1</sup> of total plutonium-238, plutonium-239/240, and plutonium-241 in water verification samples, first quarter, 2004. Concentrations are expressed in pCi/L. Samples were not filtered.

Verification samples, first quarter, 2004. Concentrations are expressed in pCi/L. Samples were not filtered.										
Sample Location	Sample Date	Plutonium-238			Plutonium-239/240		Plutonium-241			
		Concentration	± 2 SD		Concentration	± 2 SD	Concentration	± 2 SD		
Groundwater										
M1S	01/27/04	0.005	U	0.027	0.007	U	0.027	-1.2	U	4.1
M3S	01/27/04	-0.002	U	0.028	-0.002	U	0.028	-2.1	U	3.7
<sup>1</sup> Data qualifiers: U = non-detection, J = estimate, R = rejected.										

**Table 19.** Reported concentrations<sup>1</sup> of total technetium-99 in water verification samples, first quarter, 2004. Concentrations are expressed in pCi/L. Samples were not filtered.

Concentrations are expressed in pg/L. Samples were not filtered.			
Sample Location	Sample Date	Technetium-99	
		Concentration	± 2 SD
Groundwater			
M1S	01/27/04	0.6	0.1
M3S	01/27/04	0.9	0.2
<sup>1</sup> Data qualifiers: U = non-detection, J = estimate, R = rejected.			

**Table 20.** Reported concentrations<sup>1</sup> of gross alpha, gross beta, and cesium-137 in water verification samples, first quarter, 2004. Concentrations are expressed in pCi/L. Samples were not filtered.

Samples, first quarter, 2004. Concentrations are expressed in pCi/L. Samples were not filtered.										
Sample Location	Sample Date	Gross Alpha			Gross Beta			Man-made, gamma-emitting radionuclide Cesium-137		
		Concentration	± 2 SD		Concentration	± 2 SD		Concentration	± 2 SD	
Groundwater										
M1S	01/27/04	1.0	U	1.4	1.7	U	1.0	-0.3	U	1.7
M3S <sup>2</sup>	01/27/04	1.5	U	1.3	2.4	U	0.8	-0.4	U	0.9
TRA-7	03/16/04	4.0	U	2.6	3.6		1.1	0.2	U	1.2
TRA-8	03/16/04	0.9	U	2.1	4.5		1.1	-1.0	U	1.6

<sup>1</sup> Data qualifiers: U = non-detection, J = estimate, R = rejected.

<sup>2</sup> Data reflects the average of an actual sample result and the result of a corresponding laboratory split, recount, re-distillation, or re-evaporation.

**Table 21.** Reported concentrations<sup>1</sup> of total tritium in water verification samples, first quarter, 2004. Concentrations are expressed in pCi/L. Samples were not filtered.

Concentrations are expressed in pCi/L. Samples were not filtered.

Sample Location	Sample Date	Tritium	
		Concentration	± 2 SD
Groundwater			
M1S <sup>2</sup>	01/27/04	-5 U	49
M3S	01/27/04	1210	110
TRA-7	03/16/04	17920	350
TRA-8	03/16/04	3880	170
<sup>1</sup> Data qualifiers: U = non-detection, J = estimate, R = rejected.			
<sup>2</sup> Data reflects the average of an actual sample result and the result of a corresponding laboratory split, recount, re-distillation, or re-evaporation.			

**Table 22.** Reported total concentrations<sup>1</sup> of common ions for the water verification samples, first quarter, 2004. Concentrations are expressed in mg/L. Samples were not filtered.

2004. Concentrations are expressed in mg/L. Samples were not filtered.

Sample Location	Sample Date	Concentration						
		Total Alkalinity	Chloride	Iron	Silica	Sulfate	TDS <sup>2</sup>	TSS <sup>3</sup>
Groundwater								
M1S	01/27/04	96	15.3	0.42	33.2	20.7	190	<1.0 U
M3S	01/27/04	141	14.6	0.34	25.2	25.6	230	<1.0 U
TRA-7	03/16/04	132	19.6	0.30	23.4	148.0	410	5.2
TRA-8	03/16/04	166	12.0	0.25	21.3	52.7	270	<1.0 U
<sup>1</sup> Data qualifiers: U = non-detection, J = estimate, R = rejected. A "<" indicates a result below the Minimum Detectable Concentration.								
<sup>2</sup> Total dissolved solids.								
<sup>3</sup> Total suspended solids.								

**Table 23.** Reported total nutrient concentrations<sup>1</sup> for the water verification samples, first quarter, 2004. Concentrations are expressed in mg/L. Samples were not filtered.

Concentrations are expressed in mg/L. Samples were not filtered.

Sample Location	Sample Date	Concentration				
		Ammonia (as Nitrogen)	Total Kjeldahl Nitrogen	Nitrite (as Nitrogen)	Nitrite + Nitrate (as Nitrogen)	Phosphorus
Groundwater						
M1S	01/27/04	NR	NR	NR	1.08	0.019
M3S	01/27/04	NR	NR	NR	0.84	0.018
TRA-7	03/16/04	NR	NR	NR	1.33	0.028
TRA-8	03/16/04	NR	NR	NR	0.883	0.028
<sup>1</sup> Data qualifiers: U = non-detection, J = estimate, R = rejected. A "<" indicates a result below the Minimum Detectable Concentration; NR = analysis not requested.						



**Table 24.** Reported metals concentrations<sup>1</sup> for the water verification samples, first quarter, 2004. Samples were not filtered, unless otherwise noted.

Sample Location	Sample Date	Concentration											
		Calcium (mg/L)	Magnesium (mg/L)	Sodium (mg/L)	Potassium (mg/L)	Arsenic (µg/L)	Barium (µg/L)	Beryllium (µg/L)	Cadmium (µg/L)	Chromium (µg/L)	Cobalt (µg/L)	Copper (µg/L)	Iron (µg/L)
Groundwater													
M1S	01/27/04	28.0	12.0	<0.1 U	2.4	<5 U	22	<1 U	<1 U	34	<10U	<10 U	40
M3S	01/27/04	47.0	16.0	8.2	2.5	<5 U	42	<1 U	<1 U	15	<10U	<10 U	10
TRA-7	03/16/04	85.8	20.7	14.0	3.2	<5 U	92	<1 U	<1 U	140	<10U	<10 U	290
TRA-8	03/16/04	60.7	16.9	11.0	3.1	<5 U	82	<1 U	<1 U	39	<10U	<10 U	1200
<sup>1</sup> Data qualifiers: U = non-detection, J = estimate, R = rejected. A "<" indicates a result below the Minimum Detectable Concentration; NR = analysis not requested.													
<sup>2</sup> Filtered sample.													

**Table 24 continued.** Reported metals concentrations<sup>1</sup> for the verification water monitoring samples, first quarter, 2004. Samples were not filtered, unless otherwise noted.

Notes:

Sample Location	Sample Date 2004	Concentration										
		Lead (µg/L)	Manganese (µg/L)	Thallium (µg/L)	Nickel (µg/L)	Silver (µg/L)	Vanadium (µg/L)	Zinc (µg/L)	Antimony (µg/L)	Aluminum (µg/L)	Selenium (µg/L)	Mercury (µg/L)
Groundwater												
M1S <sup>2</sup>	01/27/04	<5U	<2 U	<1.5U	<10U	<1U	<100 U	5	<5U	<100U	<10U	<0.5U
M1S	01/27/04	<5U	<2 U	<1.5U	<10U	<1U	<100 U	8	<5U	<100U	<10U	<0.5U
M3S <sup>2</sup>	01/27/04	<5U	<2 U	<1.5U	<10U	<1U	<100 U	<5 U	<5U	<100U	<10U	<0.5U
M3S	01/27/04	<5U	<2 U	<1.5U	<10U	<1U	<100 U	<5 U	<5U	<100U	<10U	<0.5U
TRA-7 <sup>2</sup>	03/16/04	<5U	<2 U	<1.5U	<10U	<1U	NR	8	<5U	<100U	<10U	<0.5U
TRA-7	03/16/04	<5U	4	<1.5U	<10U	<1U	NR	130	<5U	380	<10U	<0.5U
TRA-8 <sup>2</sup>	03/16/04	<5U	3	<1.5U	<10U	<1U	NR	<5 U	<5U	<100U	<10U	<0.5U
TRA-8	03/16/04	<5U	12	<1.5U	<10U	<1U	NR	5	<5U	100	<10U	<0.5U

<sup>1</sup> Data qualifiers: U = non-detection, J = estimate, R = rejected. A "<" indicates a result below the Minimum Detectable Concentration; NR = analysis not requested.  
<sup>2</sup> Filtered sample.

**Table 25** Reported concentrations<sup>1</sup> of volatile organic compounds (VOCs) for the water verification samples, first quarter, 2004. Concentrations are expressed in µg/L. Samples were not filtered.

Analyte	Concentration		
	MDC <sup>2</sup>	M1S (Sample Date of 1/27/04)	M3S (Sample Date of 1/27/04)
Benzene	0.5	U	U
Carbon tetrachloride	0.5	U	2.6
Chlorobenzene	0.5	U	U
1,4-Dichlorobenzene	0.5	U	U
1,2-Dichlorobenzene	0.5	U	U
1,2-Dichloroethane	0.5	U	U
1,1-Dichloroethene	0.5	U	U
cis-1,2-Dichloroethene	0.5	U	U
trans-1,2-Dichloroethene	0.5	U	U
1,2-Dichloropropane	0.5	U	U
Ethylbenzene	0.5	U	U
Methylene Chloride	0.5	U	U
Styrene	0.5	U	U
Tetrachloroethylene (PERC)	0.5	U	U
Toluene	0.5	U	U
1,2,4-Trichlorobenzene	0.5	U	U
1,1,1-Trichloroethane	0.5	U	U
1,1,2-Trichloroethane	0.5	U	U
Trichloroethylene	0.5	U	0.7
Vinyl chloride	0.5	U	U
Xylenes (total)	0.5	U	U
Bromodichloromethane	0.5	U	U
Dibromochloromethane	0.5	U	U
Bromoform	0.5	U	U
Chloroform	0.5	U	U
Bromobenzene	0.5	U	U
Bromochloromethane	0.5	U	U
Bromomethane	0.5	U	U
n-Butylbenzene	0.5	U	U
sec-Butylbenzene	0.5	U	U
tert-Butylbenzene	0.5	U	U
Chloroethane	0.5	U	U
Chloromethane	0.5	U	U
2-Chlorotoluene	0.5	U	U
4-Chlorotoluene	0.5	U	U
1,2-Dibromo-3-chloropropane (DBCP)	1.0	U	U
1,2-Dibromoethane (EDB)	0.5	U	U

<sup>1</sup> Data qualifiers: U = non-detection, J = estimate, R = rejected. MDC – Minimum Detectable Concentration.

**Table 25 continued.** Reported concentrations<sup>1</sup> of volatile organic compounds (VOCs) for the water verification samples, first quarter, 2004. Concentrations are expressed in µg/L. Samples were not filtered.

Analyte	MDC <sup>2</sup>	Concentration	
		M1S (Sample Date of 1/27/04)	M3S (Sample Date of 1/27/04)
Dibromomethane	0.5	U	U
1,3-Dichlorobenzene	0.5	U	U
Dichlorodifluoromethane	0.5	U	U
1,1-Dichloroethane	0.5	U	U
1,3-Dichloropropane	0.5	U	U
2,2-Dichloropropane	0.5	U	U
1,1-Dichloropropene	0.5	U	U
cis-1,3-Dichloropropene	0.5	U	U
trans-1,3-Dichloropropene	0.5	U	U
Hexachlorobutadiene	0.5	U	U
Isopropylbenzene	0.5	U	U
p-Isopropyltoluene	0.5	U	U
Methyl Tert Butyl Ether (MTBE)	1.0	U	U
Naphthalene	1.0	U	U
n-Propylbenzene	0.5	U	U
1,1,1,2-Tetrachloroethane	0.5	U	U
1,1,2,2-Tetrachloroethane	0.5	U	U
1,2,3-Trichlorobenzene	1.25	U	U
Trichlorofluoromethane	0.5	U	U
1,2,3-Trichloropropane	0.5	U	U
1,2,4-Trimethylbenzene	0.5	U	U
1,3,5-Trimethylbenzene	0.5	U	U

<sup>1</sup> Data qualifiers: U = non-detection, J = estimate, R = rejected. MDC – Minimum Detectable Concentration.

## Terrestrial Monitoring Results

The ESP conducts terrestrial (soil and milk) sampling as an extension of air pathway surveillance. Terrestrial monitoring and verification provides an indication as to the long-term deposition and migration of contaminants in the environment, and independent verification of DOE's analytical measurement of terrestrial variables, respectively.

Results for analyses of milk samples, which are collected monthly, are presented in **Table 26**. Naturally occurring potassium-40 was detected in all samples within the expected range. Iodine-131, a man-made radionuclide, was not detected.

DEQ-INL monitors long-term radiological conditions using measurement devices capable of identifying and measuring quantities of gamma-emitting radionuclides in soil. Monitoring concentrations of gamma-emitting radionuclides in surface soil provides insight to the transport, deposition, and accumulation of

radioactive material in the environment as a result of INEEL operations and the historic atmospheric testing of nuclear weapons.

No soil samples were collected during the first quarter of 2004.

**Table 26.** Gamma spectroscopy analysis data for milk samples, first quarter, 2004. Concentrations are expressed in pCi/L.

Sample Location/Dairy	Sample Date	Naturally occurring gamma-emitting radionuclide Potassium-40 (pCi/L)		Man-made gamma-emitting radionuclide Iodine-131 <sup>1</sup>
		Concentration	± 2 SD	
Monitoring Samples				
Howe/Nelson-Ricks Creamery	1/06/04	1496	104	<MDC
	2/10/04	1462	116	<MDC
	3/09/04	1408	100	<MDC
Mud Lake/Nelson-Ricks Creamery	1/06/04	1407	110	<MDC
	2/10/04	1533	106	<MDC
	3/09/04	1477	103	<MDC
Rupert-Minidoka/Kraft	1/06/04	1548	107	<MDC
	2/10/04	1485	104	<MDC
	3/09/04	1507	113	<MDC
Gooding/Glanbia	1/09/04	1436	102	<MDC
	2/10/04	1476	113	<MDC
	3/09/04	1492	108	<MDC
Pocatello/Meadow Gold	1/06/04	1483	113	<MDC
	2/10/04	1502	118	<MDC
	3/04/04	1610	114	<MDC
Verification Samples <sup>2</sup>				
Roberts	1/06/04	1605	108	<MDC
	3/02/04	1451	101	<MDC
Idaho Falls	2/03/04	1424	114	<MDC
Moreland	3/02/04	1419	110	<MDC
Dietrich	1/06/04	1638	112	<MDC
Blackfoot	2/03/04	1452	102	<MDC
<sup>1</sup> <MDC – Less than Minimum Detectable Concentration (approximately 4 pCi/L for Iodine-131).				
<sup>2</sup> DEQ-INL samples collected by the offsite INEEL environmental surveillance contractor.				

## Quality Assurance

This section summarizes the results of the quality assurance (QA) assessment of the data collected for the first calendar quarter of 2004 for the DEQ-INL's ESP. It also summarizes the quality control (QC) samples (spikes, blanks, and duplicates) submitted to the Idaho Bureau of Laboratories-Boise (IBL) for nonradiological analyses and to Idaho State University's Environmental Monitoring Laboratory (EML) for radiological analyses during the quarter. All analyses and QC measures in the analytical laboratories are performed in accordance with approved written procedures maintained by each respective analytical laboratory. Sample collection is performed in accordance with written procedures maintained by the DEQ-INL.

The measurement of any physical quantity is subject to uncertainty from errors that may be introduced during sample collection, measurement, calibration, and the reading and reporting of results. While the sum of these inaccuracies cannot be quantified for each analytical result, a quality assurance program can evaluate the overall quality of a data set and possibly identify and address errors or inaccuracies.

Analytical results for blanks, duplicates, and spikes are used to assess the precision, accuracy, and representativeness of results from analyzing laboratories. During the first quarter of 2004, the DEQ-INL submitted 54 QC samples for various radiological and nonradiological analyses (**Table 27**).

### Blank Samples

Blank samples consist of matrices that have negligible, acceptably low, or unmeasurable amounts of the analyte(s) of interest in them. They are designed to determine if analyses will provide a "zero" result when no contaminant is expected to be present or an acceptable measure of "background," and therefore monitor any bias that may have been introduced during sample collection, storage, shipment, and analysis. Blank sample results submitted for gross alpha and gross beta screening in air for the first quarter of 2004 are presented in **Table 28** and graphically depicted in **Figures 16** and **17** over the first quarter. Blank sample results for select gamma emitters in air from composited air filters are presented in **Table 29**. Blank results for radiochemical analysis of particulate air samples are found in **Table 30**. Data for blank analyses used to assess data quality for tritium in water vapor in air are presented in **Table 31**. Additionally, no blank analyses were conducted for metals, common ion, and nutrients in ground and surface water for the first quarter of 2004. Blank analyses results for cesium-137, potassium-40, tritium, enriched tritium, gross alpha, and gross beta in ground and surface water media are presented in **Table 32**.

No anomalies were observed from the assessment of blank samples submitted to the analytical laboratories for the first quarter of 2004.

### Duplicate Samples

Duplicate samples are collected in a manner such that the samples are thought to be essentially identical in composition and are used to assess analytical precision. The difference between the original sample and the duplicate sample is expressed as a relative percent difference (RPD) and is used to measure a laboratory's ability to reproduce consistent results. For radiological analyses, the standard deviation of the differences can be used as an indicator of the overall precision of the data set. Duplicate results for ground and surface water are presented in **Table 33** for radiological analyses.

No anomalies were observed from the assessment of duplicate samples submitted to the analytical laboratories for the first quarter of 2004.

## Spiked Samples

Spiked samples are samples to which known concentrations of specific analytes have been added. One indicator of agreement is the difference between the known concentration in the sample and the measured concentration, expressed as percent recovery (%R). This quantity is calculated to assess the bias a laboratory may have in accurately measuring analytes in a particular sample. No field matrices were spiked to assess the influence of the sample media on laboratory performance. Additionally, no spiked samples were submitted for nonradiological or radiological analysis during the first quarter of 2004.

Once per quarter, DEQ-INL irradiates a number of electret ionization chambers (EIC) to verify EIC response. Irradiations of EICs are conducted in a repeatable geometry to a known exposure of 30 mR and a “blind” exposure ranging from 20 to 50 mR. EIC responses are compared directly with the exposure received from the NIST traceable cesium-137 source provided by Idaho State University. EIC response is considered acceptable if each irradiated EIC agrees within 25 percent. The irradiation results for first quarter 2004 are presented in **Table 34**.

No anomalies were observed from the assessment of measuring known irradiated quantities to EICs for the first quarter of 2004.

## Analytical QA/QC Assessment During First Quarter, 2004

No issues involving sample chain of custody, sample holding times, and data usability and completeness were observed during the first quarter of 2004. Data reports issued by the contracting laboratories conformed to the requirements of DEQ-INL. No transcription errors were noted for first quarter 2004 data.

## Preventative Maintenance and Equipment Reliability

All equipment was calibrated and checked according to pre-described periodicity. Service reliability for air sampling equipment for the first quarter is summarized in **Table 35**. Air sampling equipment requiring repair included:

- The intermediate-flow PM<sub>10</sub> sampler pump at the Fort Hall monitoring station (pump replaced - repair completed).
- The tritium sampler pump at the Fort Hall monitoring station (pump replaced - repair completed).
- The hour meter, connected to the tritium sampler pump, at the Atomic City monitoring station (hour meter replaced - repair completed).
- The low-volume air sampler (radioiodine sampler pump) at the Van Buren monitoring station (pump replaced - repair completed).
- The tritium sampler pump at the Montevue monitoring station (not repaired - low-volume air samplers at these locations are being used to sample both radioiodine and tritium).
- The tritium sampler pump at the Van Buren monitoring station (not repaired - low-volume air samplers at these locations are being used to sample both radioiodine and tritium).
- The low-volume air sampler (radioiodine sampler) rotameter at the Howe monitoring station (rotameter replaced - repair completed).

Additionally, six new low-volume air samplers were received during the quarter. These samplers will be used as back-up samplers to the samplers currently deployed.

## **Resolution of Past Analytical Issues**

During the fourth quarter of 2003, 12 samples analyzed for technetium-99 by the EML using the Empore™ disk method exceeded the MDC in all 12 samples, including those for wells that had no prior history of technetium-99 contamination. The laboratory hypothesizes that the problem was caused by an interaction between minerals in the sample water and the liquid scintillation fluid currently used (ScintiVerse™). Ongoing experiments indicate that Packard Ultima Gold XR does not exhibit the interference and it has been used for subsequent analyses. The settings for the Wallac liquid scintillation counter have been tuned to this cocktail and a qualitative inspection of the sample spectrum has been incorporated into the analysis procedure. The Packard Tri-Carb liquid scintillation counter was similarly tuned for the technetium-99 analysis. DEQ-INL concurs with this resolution.

## **Conclusion**

All data collected for the first calendar quarter of 2004 has been assigned the applicable qualifiers to designate the appropriate use of the data. In addition, all data has been verified and deemed complete, meeting the requirements and data quality objectives established by DEQ-INL.

**Table 27.** Summary of the number and distribution of analyses performed for the DEQ-INL ESP for first quarter, 2004.

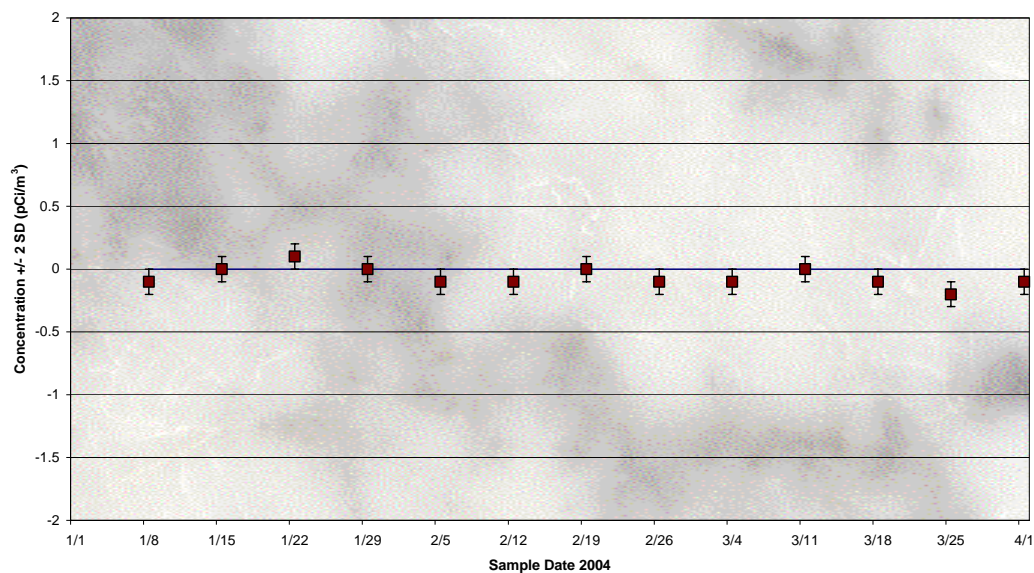
Media Type	Analyte	Test Analyses	Blank Analyses	Duplicate Analyses	Spike Analyses
<b>Air - Gaseous and Particulate</b>	Gross alpha	143	13	0	0
	Gross beta	143	13	0	0
	Gamma emitters	11	1	0	0
	Radiochemical	11	1	0	0
	Iodine-131	13	0	0	0
	Tritium	22	4	0	0
<b>Air- Precipitation</b>	Tritium	6	0	0	0
	Gamma emitters	6	0	0	0
<b>Groundwater &amp; Surface Water</b>	Gross alpha	11	1	1	0
	Gross beta	11	1	1	0
	Gamma emitters	11	1	1	0
	Tritium	11	1	1	0
	Enriched tritium	7	1	1	0
	Technicium-99	2	0	0	0
	Radiochemical	4	0	0	0
	Metals	4	0	0	0
	Common Ions	4	0	0	0
	Nutrients	4	0	0	0
	Volatile Organics	2	0	0	0
<b>Terrestrial - Milk</b>	Gamma emitters	21	0	0	0
<b>Terrestrial - Soil</b>	Gamma emitters	0	0	0	0
<b>Radiation - EICs</b>	Ambient Gamma Radiation	93	4	0	8
<b>Total Analyses by Type</b>		540	41	5	8
<b>Total of Quality Control Analyses (Blanks, Duplicates, &amp; Spikes)</b>					54
<b>Percentage of Quality Control Analyses Collected (Total # QC Analyses/Total Analyses performed)<sup>1</sup></b>					10
<sup>1</sup> Collecting quality control samples at a rate of approximately 5 to 10% of the total number of samples collected for the year is deemed appropriate for the ESP.					



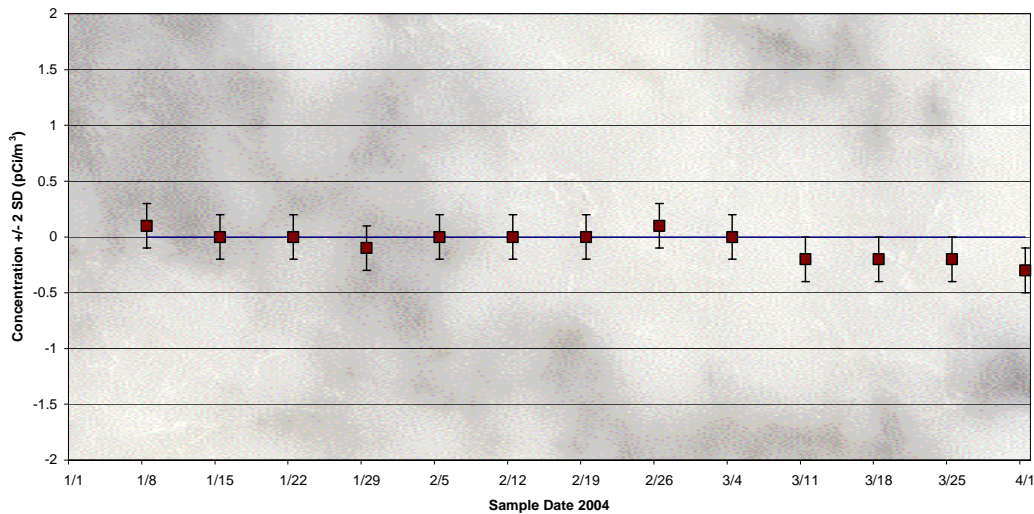
**Table 28.** Blank analysis results for gross alpha and beta in particulate air (TSP) for the first quarter, 2004. Concentrations<sup>1</sup> and associated uncertainties (2 SD) are expressed in  $1 \times 10^{-3}$  pCi/m<sup>3</sup>.

Collection Period		Corrected volume (m <sup>3</sup> ) <sup>1</sup>	Gross alpha		Gross beta	
Start	Stop		Value	Uncertainty ( $\pm 2$ SD)	Value	Uncertainty ( $\pm 2$ SD)
12/31/2003	1/8/2004	1687	-0.1	0.1	0.1	0.2
1/8/2004	1/15/2004	1687	0.0	0.1	0.0	0.2
1/15/2004	1/22/2004	1687	0.1	0.1	0.0	0.2
1/22/2004	1/29/2004	1687	0.0	0.1	-0.1	0.2
1/29/2004	2/5/2004	1687	-0.1	0.1	0.0	0.2
2/5/2004	2/12/2004	1687	-0.1	0.1	0.0	0.2
2/12/2004	2/19/2004	1687	0.0	0.1	0.0	0.2
2/19/2004	2/26/2004	1687	-0.1	0.1	0.1	0.2
2/26/2004	3/4/2004	1687	-0.1	0.1	0.0	0.2
3/4/2004	3/11/2004	1687	0.0	0.1	-0.2	0.2
3/11/2004	3/18/2004	1687	-0.1	0.1	-0.2	0.2
3/18/2004	3/25/2004	1687	-0.2	0.1	-0.2	0.2
3/25/2004	4/01/2004	1687	-0.1	0.1	-0.3	0.2

<sup>1</sup> A volume equal to the average of the volumes collected through each valid field filter was used to compute "concentrations" for the blank for meaningful comparison to sample results. No air was passed through the blank filters.



**Figure 16.** Blank analysis results for gross alpha for TSP particulate air filters for the first quarter, 2004.



**Figure 17.** Blank analysis results for gross beta for TSP particulate air filters for the first quarter, 2004.

**Table 29.** Blank analysis results for gamma spectroscopy for TSP particulate air filters for the first quarter, 2004. Concentrations<sup>1</sup> are expressed in  $1 \times 10^{-5}$  pCi/m<sup>3</sup> with associated uncertainty ( $\pm 2$  SD) and minimum detectable concentration (MDC).

Analysis Date	Berillium-7			Ruthenium-106/Rhodium-106			Antimony-125		
	Concentration	$\pm 2$ SD	MDC	Concentration	$\pm 2$ SD	MDC	Concentration	$\pm 2$ SD	MDC
1/26/2004	NR			NR			NR		
4/16/2004	13	24	40	6	26	44	-3	7	12

<sup>1</sup> These concentrations are from blank filters collected weekly, composited, and analyzed for the calendar quarter. A volume equal to the average of the volumes collected through each valid field filter was used to compute "concentrations" for the blank for meaningful comparison to sample results. No air was passed through the blank filters. NR = analysis not requested.

**Table 29 continued.** Blank analysis results for gamma spectroscopy for TSP particulate air filters for the first quarter, 2004. Concentrations<sup>1</sup> are expressed in  $1 \times 10^{-5}$  pCi/m<sup>3</sup> with associated uncertainty ( $\pm 2$  SD) and minimum detectable concentration (MDC).

Analysis Date	Cesium-134			Cesium-137		
	Concentration	$\pm 2$ SD	MDC	Concentration	$\pm 2$ SD	MDC
1/26/2004	-1	3	5	1	3	5
4/16/2004	NR			NR		

<sup>1</sup> These concentrations are from blank filters collected weekly, composited, and analyzed for the calendar quarter. A volume equal to the average of the volumes collected through each valid field filter was used to compute "concentrations" for the blank for meaningful comparison to sample results. No air was passed through the blank filters. NR = analysis not requested.

**Table 30.** Blank analysis results for annual composite radiochemical analysis for TSP particulate air filters for 2003. Concentrations<sup>1</sup> are expressed in  $1 \times 10^{-5}$  pCi/m<sup>3</sup> with associated uncertainty ( $\pm 2$  SD) and minimum detectable concentration (MDC).

Analysis Date	Strontium-90			Plutonium-238		
	Concentration	$\pm 2$ SD	MDC	Concentration	$\pm 2$ SD	MDC
2/27/2004	-0.67	0.90	1.93	NR		
3/1/2004	NR			-0.01	0.02	0.15
<sup>1</sup> These concentrations are from blank filters collected weekly, composited, and analyzed for the calendar year. A volume equal to the average of the volumes collected through each valid field filter was used to compute "concentrations" for the blank for meaningful comparison to sample results. No air was passed through the blank filters. NR = analysis not requested.						

**Table 30 continued.** Blank analysis results for annual composite radiochemical analysis for TSP particulate air filters for 2003. Concentrations<sup>1</sup> are expressed in  $1 \times 10^{-5}$  pCi/m<sup>3</sup> with associated uncertainty ( $\pm 2$  SD) and minimum detectable concentration (MDC).

Analysis Date	Plutonium-239/Plutonium-240			Americium-241		
	Concentration	$\pm 2$ SD	MDC	Concentration	$\pm 2$ SD	MDC
2/27/2004	NR			NR		
3/1/2004	0.06	0.09	0.08	0.04	0.08	0.11
<sup>1</sup> These concentrations are from blank filters collected weekly, composited, and analyzed for the calendar year. A volume equal to the average of the volumes collected through each valid field filter was used to compute "concentrations" for the blank for meaningful comparison to sample results. No air was passed through the blank filters. NR = analysis not requested.						

**Table 31.** Blank analysis results for tritium water vapor from air samples for the first quarter, 2004 . Concentrations are expressed in pCi/L with associated uncertainty ( $\pm 2$  SD) and minimum detectable concentration (MDC).

Sample Number	Start Date	Collect Date	Analysis Date	Tritium		
				Concentration	$\pm 2$ SD	MDC
OP041ZTR01	3/22/2004	3/22/2004	4/23/04	-20	70	130
OP041ZTR02	3/22/2004	3/22/2004	4/23/04	-20	70	120
OP041ZTR03	4/14/2004	4/14/2004	4/23/04	-30	70	120
OP041ZTR04	4/14/2004	4/14/2004	4/23/04	30	70	120

**Table 32.** Blank analysis results for cesium-137, potassium-40, tritium, and enriched tritium in ground and surface water samples for the first quarter, 2004. Concentrations<sup>1</sup> are expressed in pCi/L with associated uncertainty ( $\pm 2$  SD) and minimum detectable concentration (MDC).

Sample Number	Cesium-137			Potassium-40			Tritium			Enriched Tritium			Gross Alpha			Gross Beta		
	Concentration	$\pm 2$ SD	MDC	Concentration	$\pm 2$ SD	MDC	Concentration	$\pm 2$ SD	MDC	Concentration	$\pm 2$ SD	MDC	Concentration	$\pm 2$ SD	MDC	Concentration	$\pm 2$ SD	MDC
041W017	2	1.7	2.7	-2	38	65	NR <sup>1</sup>			NR <sup>1</sup>			0.0	0.6	1.0	0.4	0.8	1.3
041W018	NR <sup>1</sup>			NR <sup>1</sup>			0.00	0.07	0.12	41	7	9	NR <sup>1</sup>			NR <sup>1</sup>		

<sup>1</sup> NR = analysis not requested.

**Table 33.** Duplicate radiological analysis results (in pCi/L) for ground and surface water, first quarter, 2004.

Analysis/ Sample Location	Original Sample Number	Analysis Date	Concentration	$\pm 2$ SD	Duplicate Sample Number	Analysis Date	Concentration	$\pm 2$ SD	$ R_1 - R_2 $	$3(s_1^2 + s_2^2)^{1/2}$	Within Criteria? <sup>1</sup>
<b>Gross Alpha</b>											
Shoshone Water Supply	041W013	2/27/04	1.8	2.1	041W015	3/1/04	2.1	1.8	0.3	4.15	Yes
<b>Gross Beta</b>											
Shoshone Water Supply	041W013	2/27/04	2.6	1.1	041W015	3/1/04	3.2	1.0	0.6	2.23	Yes
<b>Gamma Spectroscopy Cesium-137</b>											
Shoshone Water Supply	041W013	2/27/04	-1.0	1.4	041W015	2/26/04	0.7	1.4	1.7	2.97	Yes
<b>Gamma Spectroscopy Potassium-40</b>											
Shoshone Water Supply	041W013	2/27/04	-30	41	041W015	2/26/04	28	42	58.0	88.04	Yes
<b>Tritium</b>											
Shoshone Water Supply	041W014	3/1/04	10	70	041W016	3/1/04	20	70	10.0	148.49	Yes
<b>Enriched Tritium</b>											
Shoshone Water Supply	041W014	3/1/04	39	7	041W016	3/1/04	38	7	1.0	14.85	Yes

<sup>1</sup>  $|R_1 - R_2| \leq 3(s_1^2 + s_2^2)^{1/2}$

**Table 34.** Electret ionization chamber irradiation results for first quarter, 2004. A percent recovery (%R) of  $100 \pm 25$  is considered acceptable.

Electret #	Exposure Received		Gross Measured Exposure		Background <sup>1</sup>		Net Exposure <sup>2</sup>		%R
	(mR)	Uncertainty (mR)	(mR)	Uncertainty (mR)	(mR)	Uncertainty (mR)	(mR)	Uncertainty <sup>3</sup> (mR)	
S1	30.0	1.50	36.4	1.37	0.46	0.91	35.9	1.54	19.9
S2	30.0	1.50	34.9	1.38	0.46	0.91	34.5	1.55	15.1
S3	30.0	1.50	35.8	1.28	0.46	0.91	35.4	1.45	18.0
S4	30.0	1.50	31.5	1.37	0.46	0.91	31.0	1.54	3.6
S5	23.9	1.20	26.7	1.36	0.46	0.91	26.3	1.53	9.8
S6	23.9	1.20	29.3	1.30	0.46	0.91	28.9	1.47	20.5
S7	23.9	1.20	29.3	1.39	0.46	0.91	28.8	1.55	20.4
S8	23.9	1.20	27.9	1.24	0.46	0.91	27.4	1.43	14.6

<sup>1</sup> Four EICs were used for control measurements (counted as blanks) and were not irradiated. Background exposure, as measured by the control group, was  $0.46 \pm 0.91$  mR.  
<sup>2</sup> [Gross Measured Exposure] – [Background].  
<sup>3</sup> Total propagated error.

**Table 35.** Air sampling field equipment service reliability (% operational) for first quarter 2004. These values were calculated by dividing the number of weeks the equipment was in operation by the number of weeks in the quarter.

Station Locations	Sample Type <sup>1</sup>				
	PM <sub>10</sub>	TSP	Radioiodine	Atmospheric Moisture	Precipitation
<b>Onsite Locations</b>					
Big Lost River Rest Area	NC	100%	100%	100%	100%
Experimental Field Station	NC	100%	100%	100%	NC
Sand Dunes Tower	NC	100%	100%	100%	NC
Van Buren Avenue	NC	100%	92%	92%	NC
<b>Boundary Locations</b>					
Atomic City	100%	100%	CP	100%	100%
Howe	NC	100%	100%	100%	100%
Montevieu	NC	100%	100%	92%	100%
Mud Lake	92% <sup>2</sup>	100%	CP	100%	100%
<b>Distant Locations</b>					
Craters of the Moon	NC	100%	100%	100%	NC
Fort Hall <sup>3</sup>	100%	100%	CP	92%	NC
Idaho Falls	NC	100%	100%	100%	100%
<sup>1</sup> NC = sample not collected at this location; CP = sample collected using the PM <sub>10</sub> sampler at this location. <sup>2</sup> No mechanical repair was required for the Mud Lake PM <sub>10</sub> sampler pump. Speculation as to the loss of service was most likely due to a local loss of electrical power. <sup>3</sup> Operated by Shoshone-Bannock Tribes.					

## Appendix A

**Table A1.** Weekly concentrations (in  $1 \times 10^{-3}$  pCi/m<sup>3</sup>) for gross alpha and gross beta analyses for TSP filters for all locations, first quarter, 2004.

Sample Location	Collection Date		Gross Alpha		Gross Beta	
	Start	Stop	Concentration	± 2 SD	Concentration	± 2 SD
<b>On-Site Locations</b>						
Big Lost River Rest Area	12/31/03	01/08/04	0.5	0.2	15.6	0.9
	01/08/04	01/15/04	2.5	0.4	35.0	1.2
	01/15/04	01/22/04	1.3	0.2	66.8	1.6
	01/22/04	01/29/04	0.3	0.2	30.7	1.1
	01/29/04	02/05/04	0.3	0.2	14.9	0.8
	02/05/04	02/12/04	0.2	0.2	17.2	0.8
	02/12/04	02/19/04	0.6	0.2	35.5	1.2
	02/19/04	02/26/04	0.5	0.2	19.2	0.9
	02/26/04	03/04/04	0.2	0.2	12.7	0.7
	03/04/04	03/11/04	0.5	0.2	17.9	0.9
	03/11/04	03/18/04	0.5	0.2	24.1	1.0
	03/18/04	03/25/04	0.9	0.3	29.3	1.1
	03/25/04	04/01/04	0.6	0.2	11.7	0.7
Experimental Field Station	12/31/03	01/08/04	0.2	0.2	16.2	0.7
	01/08/04	01/15/04	3.5	0.4	48.8	1.4
	01/15/04	01/22/04	1.6	0.3	89.2	1.8
	01/22/04	01/29/04	0.6	0.2	34.7	1.1
	01/29/04	02/05/04	0.2	0.2	16.8	0.8
	02/05/04	02/12/04	0.1	0.2	16.5	0.8
	02/12/04	02/19/04	0.7	0.2	42.9	1.3
	02/19/04	02/26/04	0.2	0.2	18.6	0.8
	02/26/04	03/04/04	0.2	0.2	11.0	0.7
	03/04/04	03/11/04	0.8	0.2	18.8	0.9
	03/11/04	03/18/04	0.8	0.2	24.1	1.0
	03/18/04	03/25/04	0.8	0.3	25.7	1.2
	03/25/04	04/01/04	0.5	0.2	12.1	0.7
<sup>1</sup> Operated by Shoshone-Bannock Tribes.						

**Table A1 continued.** Weekly concentrations (in  $1 \times 10^{-3}$  pCi/m<sup>3</sup>) for gross alpha and gross beta analyses for TSP filters for all locations, first quarter, 2004.

Sample Location	Collection Date		Gross Alpha		Gross Beta	
	Start	Stop	Concentration	± 2 SD	Concentration	± 2 SD
Sand Dunes Tower	12/31/03	01/08/04	0.3	0.2	18.0	0.8
	01/08/04	01/15/04	3.7	0.5	52.9	1.7
	01/15/04	01/22/04	1.1	0.2	79.8	1.7
	01/22/04	01/29/04	1.0	0.2	40.0	1.2
	01/29/04	02/05/04	0.2	0.2	16.2	0.8
	02/05/04	02/12/04	0.1	0.2	17.7	0.8
	02/12/04	02/19/04	0.9	0.2	43.4	1.2
	02/19/04	02/26/04	0.2	0.2	17.4	0.8
	02/26/04	03/04/04	0.3	0.2	10.4	0.6
	03/04/04	03/11/04	0.6	0.2	17.7	0.8
	03/11/04	03/18/04	0.7	0.2	21.5	0.9
	03/18/04	03/25/04	1.0	0.3	26.0	1.2
	03/25/04	04/01/04	0.5	0.2	12.0	0.7
Van Buren Avenue	12/31/03	01/08/04	0.3	0.2	16.4	0.7
	01/08/04	01/15/04	2.8	0.4	42.1	1.3
	01/15/04	01/22/04	1.5	0.3	81.2	1.7
	01/22/04	01/29/04	0.8	0.3	40.2	1.6
	01/29/04	02/05/04	0.2	0.2	14.9	0.8
	02/05/04	02/12/04	0.3	0.2	17.0	0.8
	02/12/04	02/19/04	0.8	0.2	39.9	1.2
	02/19/04	02/26/04	0.4	0.2	18.9	0.9
	02/26/04	03/04/04	0.4	0.2	10.9	0.7
	03/04/04	03/11/04	0.6	0.2	19.2	0.9
	03/11/04	03/18/04	0.7	0.2	22.4	0.9
	03/18/04	03/25/04	0.8	0.2	27.8	1.0
	03/25/04	04/01/04	1.0	0.3	14.3	0.9
<b>Boundary Locations</b>						
Atomic City	12/31/03	01/08/04	0.2	0.2	18.7	0.8
	01/08/04	01/15/04	0.6	0.2	55.1	1.5
	01/15/04	01/22/04	1.2	0.2	86.1	1.8
	01/22/04	01/29/04	0.5	0.2	27.9	1.1
	01/29/04	02/05/04	0.3	0.2	16.4	0.8
	02/05/04	02/12/04	0.2	0.2	19.1	0.9
	02/12/04	02/19/04	0.9	0.2	45.8	1.4
	02/19/04	02/26/04	0.5	0.2	22.2	1.0
	02/26/04	03/04/04	0.4	0.2	12.1	0.7
	03/04/04	03/11/04	0.5	0.2	19.6	0.9
	03/11/04	03/18/04	0.7	0.2	23.7	1.0
	03/18/04	03/25/04	1.2	0.3	31.5	1.1
	03/25/04	04/01/04	0.6	0.2	13.9	0.8
<sup>1</sup> Operated by Shoshone-Bannock Tribes.						



**Table A1 continued.** Weekly concentrations (in  $1 \times 10^{-3}$  pCi/m<sup>3</sup>) for gross alpha and gross beta analyses for TSP filters for all locations, first quarter, 2004.

Sample Location	Collection Date		Gross Alpha		Gross Beta	
	Start	Stop	Concentration	± 2 SD	Concentration	± 2 SD
Howe	12/31/03	01/08/04	0.3	0.2	14.9	0.7
	01/08/04	01/15/04	2.6	0.3	36.2	1.2
	01/15/04	01/22/04	1.4	0.2	73.5	1.6
	01/22/04	01/29/04	0.6	0.2	31.9	1.1
	01/29/04	02/05/04	0.1	0.2	15.7	0.8
	02/05/04	02/12/04	0.1	0.1	15.5	0.8
	02/12/04	02/19/04	0.6	0.2	35.3	1.1
	02/19/04	02/26/04	0.3	0.2	17.1	0.8
	02/26/04	03/04/04	0.4	0.2	10.0	0.6
	03/04/04	03/11/04	0.4	0.2	16.1	0.8
	03/11/04	03/18/04	0.7	0.2	20.7	0.9
	03/18/04	03/25/04	1.1	0.3	24.4	1.0
	03/25/04	04/01/04	0.6	0.2	11.5	0.7
Montevideo	12/31/03	01/08/04	0.2	0.1	14.9	0.7
	01/08/04	01/15/04	3.5	0.4	53.4	1.4
	01/15/04	01/22/04	1.2	0.2	68.9	1.5
	01/22/04	01/29/04	0.6	0.2	37.6	1.1
	01/29/04	02/05/04	0.3	0.2	16.8	0.8
	02/05/04	02/12/04	0.3	0.2	15.6	0.8
	02/12/04	02/19/04	0.5	0.2	32.2	1.1
	02/19/04	02/26/04	0.3	0.2	14.5	0.7
	02/26/04	03/04/04	0.2	0.1	9.6	0.6
	03/04/04	03/11/04	0.5	0.2	17.4	0.8
	03/11/04	03/18/04	0.4	0.2	18.9	0.8
	03/18/04	03/25/04	1.1	0.2	20.7	0.9
	03/25/04	04/01/04	0.7	0.2	10.7	0.7
Mud Lake	12/31/03	01/08/04	0.4	0.2	16.5	0.7
	01/08/04	01/15/04	3.8	0.4	54.7	1.4
	01/15/04	01/22/04	1.7	0.3	87.8	1.8
	01/22/04	01/29/04	0.9	0.2	36.2	1.1
	01/29/04	02/05/04	0.1	0.2	16.9	0.8
	02/05/04	02/12/04	0.1	0.1	16.4	0.8
	02/12/04	02/19/04	0.9	0.2	40.9	1.2
	02/19/04	02/26/04	0.4	0.2	18.5	0.8
	02/26/04	03/04/04	0.3	0.2	9.8	0.6
	03/04/04	03/11/04	0.6	0.2	16.9	0.8
	03/11/04	03/18/04	0.7	0.3	20.1	1.1
	03/18/04	03/25/04	1.4	0.3	23.7	1.0
	03/25/04	04/01/04	0.8	0.2	12.0	0.7

<sup>1</sup> Operated by Shoshone-Bannock Tribes.

**Table A1 continued.** Weekly concentrations (in  $1 \times 10^{-3}$  pCi/m<sup>3</sup>) for gross alpha and gross beta analyses for TSP filters for all locations, first quarter, 2004.

Sample Location	Collection Date		Gross Alpha		Gross Beta	
	Start	Stop	Concentration	± 2 SD	Concentration	± 2 SD
<b>Distant Locations</b>						
Craters of the Moon	12/31/03	01/08/04	0.3	0.2	10.9	0.6
	01/08/04	01/15/04	0.4	0.2	29.2	1.1
	01/15/04	01/22/04	1.0	0.2	48.4	1.4
	01/22/04	01/29/04	0.5	0.2	18.5	0.9
	01/29/04	02/05/04	0.2	0.2	10.8	0.7
	02/05/04	02/12/04	0.2	0.2	11.3	0.7
	02/12/04	02/19/04	0.7	0.2	28.6	1.1
	02/19/04	02/26/04	0.4	0.2	15.3	0.8
	02/26/04	03/04/04	0.3	0.2	9.7	0.6
	03/04/04	03/11/04	0.5	0.2	14.4	0.8
	03/11/04	03/18/04	0.3	0.2	15.4	0.8
	03/18/04	03/25/04	0.6	0.2	22.5	1.0
	03/25/04	04/01/04	0.4	0.2	10.7	0.7
Fort Hall <sup>1</sup>	12/31/03	01/08/04	0.2	0.1	13.7	0.6
	01/08/04	01/15/04	3.1	0.5	41.7	1.6
	01/15/04	01/22/04	1.6	0.3	67.0	1.5
	01/22/04	01/29/04	0.4	0.2	17.4	0.8
	01/29/04	02/05/04	0.3	0.2	11.0	0.6
	02/05/04	02/12/04	0.3	0.2	14.0	0.7
	02/12/04	02/19/04	1.2	0.2	32.9	1.1
	02/19/04	02/26/04	0.8	0.2	17.6	0.8
	02/26/04	03/04/04	0.5	0.2	7.9	0.6
	03/04/04	03/11/04	1.1	0.2	14.2	0.8
	03/11/04	03/18/04	1.0	0.2	17.7	0.8
	03/18/04	03/25/04	1.5	0.3	21.8	0.9
	03/25/04	04/01/04	0.8	0.2	10.2	0.7
Idaho Falls	12/31/03	01/08/04	0.4	0.2	16.6	0.7
	01/08/04	01/15/04	3.0	0.4	45.9	1.3
	01/15/04	01/22/04	1.6	0.3	82.9	1.7
	01/22/04	01/29/04	0.7	0.2	33.9	1.1
	01/29/04	02/05/04	0.2	0.2	12.8	0.7
	02/05/04	02/12/04	0.4	0.2	16.7	0.8
	02/12/04	02/19/04	1.1	0.2	39.6	1.2
	02/19/04	02/26/04	0.6	0.2	21.5	0.9
	02/26/04	03/04/04	0.2	0.2	10.5	0.6
	03/04/04	03/11/04	0.5	0.2	19.2	0.8
	03/11/04	03/18/04	0.9	0.2	21.0	0.9
	03/18/04	03/25/04	1.3	0.3	26.7	1.0
	03/25/04	04/01/04	0.6	0.2	12.4	0.7

<sup>1</sup> Operated by Shoshone-Bannock Tribes.

## Appendix B

**Table B1.** Weekly concentrations (in  $1 \times 10^{-3}$  pCi/m<sup>3</sup>) for gross alpha and gross beta analyses for PM<sub>10</sub> air samples for all locations, first quarter, 2004.

Sample Location	Collection Date		Gross Alpha		Gross Beta	
	Start	Stop	Concentration	± 2 SD	Concentration	± 2 SD
Atomic City	12/31/03	01/08/04	0.6	0.3	27.8	1.4
	01/08/04	01/15/04	0.7	0.4	74.9	2.3
	01/15/04	01/22/04	2.6	0.5	157.3	3.3
	01/22/04	01/29/04	1.3	0.4	53.7	2.0
	01/29/04	02/05/04	0.3	0.4	22.4	1.6
	02/05/04	02/12/04	0.6	0.3	27.8	1.5
	02/12/04	02/19/04	1.5	0.4	69.1	2.3
	02/19/04	02/26/04	0.2	0.3	31.8	1.6
	02/26/04	03/04/04	0.1	0.3	15.0	1.1
	03/04/04	03/11/04	1.1	0.5	33.8	2.0
	03/11/04	03/18/04	0.9	0.4	34.9	1.6
	03/18/04	03/25/04	1.2	0.4	44.6	1.9
	03/25/04	04/01/04	0.6	0.4	17.1	1.5
Mud Lake	12/31/03	01/08/04	0.4	0.4	24.6	1.6
	01/08/04	01/15/04	1.5	0.4	92.0	2.6
	01/15/04	01/22/04	2.7	0.5	146.2	3.2
	01/22/04	01/29/04	0.7	0.3	63.1	2.1
	01/29/04	02/05/04	0.5	0.3	27.8	1.5
	02/05/04	02/12/04	0.2	0.3	24.1	1.4
	02/12/04	02/19/04	1.2	0.4	65.1	2.2
	02/19/04	02/26/04	0.5	0.3	25.3	1.4
	02/26/04	03/04/04	0.3	0.4	12.4	1.3
	03/04/04	03/11/04	0.8	0.3	18.9	1.2
	03/11/04	03/18/04	1.1	0.4	29.7	1.5
	03/18/04	03/25/04	NS <sup>1</sup>		NS <sup>1</sup>	
	03/25/04	04/01/04	0.6	0.3	14.5	1.1
<sup>1</sup> No sample obtained due to equipment failure.						
<sup>2</sup> Operated by Shoshone-Bannock Tribes.						

**Table B1 continued.** Weekly concentrations (in  $1 \times 10^{-3}$  pCi/m<sup>3</sup>) for gross alpha and gross beta analyses for PM<sub>10</sub> air samples for all locations, first quarter, 2004.

Sample Location	Collection Date		Gross Alpha		Gross Beta	
	Start	Stop	Concentration	± 2 SD	Concentration	± 2 SD
Fort Hall <sup>2</sup>	12/31/03	01/08/04	0.3	0.3	14.7	1.0
	01/08/04	01/15/04	4.9	0.7	66.9	2.3
	01/15/04	01/22/04	1.9	0.4	101.6	2.7
	01/22/04	01/29/04	1.1	0.4	43.4	1.8
	01/29/04	02/05/04	0.0	0.3	13.8	1.1
	02/05/04	02/12/04	0.2	0.3	18.6	1.2
	02/12/04	02/19/04	NS <sup>1</sup>		NS <sup>1</sup>	
	02/19/04	02/26/04	NS <sup>1</sup>		NS <sup>1</sup>	
	02/26/04	03/04/04	0.4	0.3	12.7	1.1
	03/04/04	03/11/04	1.4	0.4	26.6	1.5
	03/11/04	03/18/04	1.4	0.5	27.3	1.5
	03/18/04	03/25/04	1.1	0.4	40.8	1.8
	03/25/04	04/01/04	0.3	0.3	14.7	1.0
<sup>1</sup> No sample obtained due to equipment failure.						
<sup>2</sup> Operated by Shoshone-Bannock Tribes.						

## Appendix C

**Table C-1.** Results for additional electret locations, first quarter, 2004.

Sample Location	Net Corrected Exposure (uR/h)	± 2 SD (uR/h)
Dubois	18.51	1.92
Hamer	17.30	1.89
Sugar City	19.87	1.97
Blue Dome	15.77	1.84
TAN	19.23	1.95
ICPP I	19.13	1.94
NRF	14.99	1.95
EBR II	17.52	1.82
TRA	14.66	1.91
Grid 3	16.34	1.83
PBF	11.93	1.72
CFA	14.94	1.80
RWMC	13.81	1.78
Roberts	13.82	1.90
Kettle Butte	14.97	1.81
Blackfoot	19.15	2.04
Taber	14.52	1.82
Aberdeen	17.30	2.01
Minidoka	18.59	2.06
Arco	17.50	1.28
Richfield	18.84	1.36
EBR I	19.89	2.42
Reno Ranch	19.40	1.37
Rover Rd. 2.9mi	19.66	1.38
Rover Rd. 4.9mi	20.15	1.41
Rover Rd. 6.3mi	18.40	2.01
Rover Rd. 6.8mi <sup>1</sup>	20.02	2.06
Rover Rd. 8.8mi <sup>1</sup>	17.87	2.00
Rover Rd. 10.8mi <sup>1</sup>	18.85	2.02
Rover Rd. 15.4mi <sup>1</sup>	18.84	2.03
Rover Rd. 17.4mi <sup>1</sup>	20.42	2.07
MP1 - 22/33	22.89	3.72
MP3 - 22/33	18.51	1.92
MP5 - 22/33	17.30	1.89
MP7 - 22/33	19.87	1.97
MP9 - 22/33	15.77	1.84
MP23 – 33	19.23	1.95
MP25 – 33	19.13	1.94

<sup>1</sup> EIC was collected at this location during the first quarter of 2004 due to inaccessibility from excessive snow present during the fourth quarter of 2003.

**Table C-1 continued.** Results for additional electret locations, first quarter, 2004.

Sample Location	Net Corrected Exposure (uR/h)	± 2 SD (uR/h)
MP27 – 33	23.31	2.16
MP29 – 33	19.30	2.03
MP31 – 33	19.38	3.51
MP33 – 33	24.41	2.20
MP35 – 33	20.02	2.05
MP37 – 33	19.81	2.04
MP39 – 33	19.53	2.03
MP41 – 33	25.15	3.86
MP43 – 33	21.98	2.12
Mud Lake - Bank of Commerce	17.83	1.87
MP1 - Lincoln Blvd	17.98	1.90
MP5 - Lincoln Blvd	16.79	1.87
MP7 - Lincoln Blvd	20.58	1.99
MP9 - Lincoln Blvd	20.34	1.99
MP11 - Lincoln Blvd	18.24	1.92
MP13 - Lincoln Blvd	20.22	1.98
MP15 - Lincoln Blvd	17.36	1.88
MP17 - Lincoln Blvd	22.10	2.05
MP19 - Lincoln Blvd	19.43	1.95
MP21 - Lincoln Blvd	19.51	1.95
MP264 – 20	17.05	1.93
MP266 – 20	15.06	1.87
MP268 – 20	20.06	2.48
MP270 – 20	15.69	1.89
MP272 – 20	14.17	1.84
MP274 – 20	15.44	1.88
MP276 – 20	18.29	1.96
MP270 - 20/26	18.63	1.97
MP268 - 20/26	18.69	1.97
MP266 - 20/26	20.06	2.02
MP263 - 20/26	17.73	1.94
MP261 - 20/26	17.15	1.92
MP259 - 20/26	16.18	1.90
Howe Fence-line 1.4mi <sup>1</sup>	19.87	1.39
Howe Fence-line 2.3mi <sup>1</sup>	20.06	1.40
Howe Fence-line 4.2mi <sup>1</sup>	18.19	1.31
Howe Fence-line 6.5mi <sup>1</sup>	14.93	1.16
Howe Fence-line 8.6mi <sup>1</sup>	15.66	1.20
Howe Fence-line 9.7mi <sup>1</sup>	16.25	1.22
Howe Met. Tower	18.45	1.91
<sup>1</sup> EIC was collected at this location during the first quarter of 2004 due to inaccessibility from excessive snow present during the fourth quarter of 2003.		